SCIENCE

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CONTENTS

MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

THE PROBLEM OF THE ASSISTANT PROFESSOR

PART I

THERE has been for some years a growing appreciation among educational institutions of the fact that their problems are not entirely individual, but present many aspects in common, and that much good may come from joint effort toward their solution. The very existence of this association sufficiently demonstrates this fact, and also amply justifies the aim of this paper. The topic offers material for a volume; the limitations of space and time for preparation have made the task of presentation chiefly one of selection and manner. The prime effort has been directed toward stating the problem of the assistant professor in concrete terms, and the method adopted may be likened to that of composite photography. Its limitations are obvious, but it has the advantage of focusing well on the main features, while enabling one to treat individual data without danger of personal identification.

A questionaire (Appendix A) was prepared and sent out to approximately 250 of the men holding the rank of assistant professor in the 22 institutions represented in this association. When replies had been received to about one half (120) of these, the writer felt forced to begin his work of compilation, in order that in the time at his disposal he might complete the collation, and have a definite result to present in this paper. Replies have continued, but they run just about the same as those here considered, and in no manner call for any essential modification of the general re-

sults. Casting out replies of those whose service was but for part time and special in kind (chiefly those holding clinical positions with nominal salaries and slight administrative connection), there remained 112 replies from 20 institutions. The initial step was to tabulate the answers to the first 17 questions, and from that tabulation the following results were compiled. The first point is that of the present age of the men replying. Table I. gives the result:

TABLE I

Present Age of Assistant Professors

(Two Replies Blank)

Age	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	51	58
Number	1	0	1	6	5	4	8	6	5	6	10	10	4	6	4	7	1	6	5	2	2	5	1	1	2	1	1

Group 1 — 36 median age. 52 under, 48 over. Average age, 36.8 years.

Group 2 — 24.6 per cent. of total.

TABLE II

Age at Appointment as Assistant Professor

(Five Replies, Age not Given)

Age	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	47
Number	2	4	1	6	12	9	10	8	10	10	6	6	7	4	2	1	1	1	1	2	1	2	1

Group 1 — 31 median age. 52 under, 45 over. Average age at appointment, 31.25 years.

Group 2 — 9.33 per cent. of total.

The average age is 36.8 years; 36 may also be considered the median age, as 52 of the men were under this age, while 58 were 36 years or older. Two did not state their age. Just here I wish to call attention to evidence offered by this table on an important point. The men fall into two main groups, one under 40 and one over 40. The existence of this second group (24.6 per cent. of the total) with ages running from 40 to 58, points decidedly toward the existence of a class of permanent assistant professors. This is an important matter, and must seriously modify the prevailing view that assistant professors are young men temporarily occupying the rank on their march toward full professorship. If this point be well taken—and the writer fully believes it so to be—an entire readjustment of attitude toward the assistant professor is due. Compensation based upon the old conception will be found inadequate, and old forms of faculty organization and departmental administration will be found unduly repressive and subordinating toward amply tried and experienced men.

Bearing further on this point of age is Table II., which shows the age at which these men attained assistant professorship.

The average age of appointment is 31.25 years. 31 is also the median age, 52 being appointed at an earlier age than this and 55 at this or a later one. In considering some of the subsequent facts, it may be well to bear in mind that the years from 31 to 37 may properly be regarded as the cream of a man's life. "Who *is* not at twenty, *does* not at thirty, *has* not at forty, never will be, do, or have."

The average time spent in collegiate or graduate study has been 6.9 years. Seven-

teen men (15 per cent.) hold the degree of bachelor only; 28 (25 per cent.) hold none above master; while 65 (58 per cent.) hold that of doctor. Two only, whose work is in a special branch of technology, hold no degree.

63.5 per cent. received assistance in pursuing their studies, in the form of scholarships, fellowships, teaching fellowships, assistantships, student instructorships, etc. The amount varied from a single year's free tuition to a net equivalent of $2,000. No average can be struck of these or of their financial value. 36.5 per cent. received no such aid. 53.5 per cent. incurred no indebtedness for their education. 46.5 per cent. did incur such indebtedness, the average amount being $885. Of those who incurred this indebtedness, 82 per cent. have discharged it. The average sum was $800, and the average time required was 3.6 years. The remaining 18 per cent., whose debt average $1,261, have not yet succeeded in paying it off, although in some cases it has been running six, eight and even ten years. The depressing nature of such a burden need not be dwelt upon.

With the facts before him which these replies have brought, the writer is deeply impressed by the deplorable effect of the system of scholarships, etc., which do not entirely support the recipient, but act as bait and encourage him to go on with graduate study, while piling up an indebtedness which, under prevailing conditions, will ride his shoulders like a veritable old man of the sea. It is a good way to break hearts.

These histories disclose the fact that it is a pretty serious matter for a man to go even $1,000 into debt in order to enter the career of university teaching. The *manipulation* of fellowships for the purpose of "building up a strong (*i. e.*, large) graduate department" lies dangerously near the immoral; and this is doubly true when the fellowship carries with it burdensome teaching duties which make of it but a disguised, underpaid instructorship. This is making one hand wash the other in a way worthy of financial wizards. Nor can the practise of some professors of looking upon "their" fellows as a sort of intellectual valets, be too strongly condemned. A genuine fellowship will carry sufficient stipend to bear the entire burden of the recipient's cost of living on a modest scale, leave his time wholly free for his studies, and will take its sole return in deferred service to be rendered to society at large.

We next come to the question of the professorial experience of these men. The total teaching service in all ranks averages 10.3 years. Nine years is the medium period, just half having served a shorter time, and the other half a longer time than this. On the average they have served $5\frac{1}{4}$ years in the rank of assistant professor; 5 years is also about the median period, 53 per cent. having served a shorter term and 47 per cent. 5 years or more. Twelve per cent. have held the rank for ten years or more. This service is shown in Table III.

TABLE III

Years of Service as Assistant Professor

(One Reply Lacking)

Years	1	2	3	4	5	6	7	8	9	10	11	12	16	18	30
Number	11	20	17	10	14	6	7	7	6	4	1	5	1	1	1
	58				53										
	under 5 years.				5 years or over.										

Of the 112, 83 (74 per cent.) are married and 29 (26 per cent.) are unmarried. Table IV. shows the number and distribution of children in this group of men. No comment, beyond a reminder that the average age of these men is 36.8 years, is necessary.

The present average salary is $1,790.

TABLE IV

Number and Distribution of Children

		Total Children
Number having 0 child,	23	0
Number having 1 child,	26	26
Number having 2 children,	19	38
Number having 3 children,	12	36
Number having 4 children,	1	4
Number having 6 children,	1	6
Number having 7 children,	1	7
	83	117

117/83 = 1.4 to the family of each married.

The median salary is $1,800, 21.5 per cent. receiving just this sum, 46 per cent. receiving less and 33.5 per cent. more. The average salary for the entire 10.3 years of teaching service is $1,325. (An interesting check on this is the writer's average of $1,328.15 for his first nine years of service, reported in the *Atlantic Monthly*, May, 1905.)

Now let us focus these facts into our composite representative man. At the age of 26 or 27, after seven years of collegiate and graduate study, involving not only considerable outlay but also the important item of the foregoing of earning during this period, he is the proud possessor of his Ph.D. and is ready to enter his profession. The next five years he spends as instructor. In his thirty-second year he reaches an assistant professorship. He is now in his thirty-seventh year, having been an assistant professor for five years. His average salary for the ten years has been $1,325, which compares favorably with that of the good mechanic, but scarcely with that of men in those trained professions requiring equally arduous and expensive preparation. At thirty-seven he is married, has one child, and a salary of $1,800. These are men in twenty of the leading universities, located for the greater part in or near the larger cities!

An average salary of $1,325 for the years of a man's life between 27 and 37 is scarcely one to favor a broadening contact with life, the purchase of books, travel, association with cultivated men outside of academic ranks, etc. The most that can be said is that it may suffice for an unmarried man with no one dependent upon him. But three fourths of these men are married. Says one of these: "Previous to marriage my salary was sufficient to keep me comfortably. Since marriage, *in spite of* keeping boarders, I have fallen behind."[1]

It is therefore not at all astonishing to find that 80 per cent. have supplemented their salary with income from outside sources. No complete average can be struck, as the replies included such answers as "to a considerable extent," etc. The amount when stated (as it was in 75 cases) varied from a sum of $15 total to an independent annual income of $10,000 and averaged 28.7 per cent. of the salary. Omitting two exceptionally high cases, it was about 25 per cent.

The necessity to supplement the salary with outside income is evident from the fact that eight men report themselves running behind even on total income, while practising strictest economy. Light

[1] Compare President Eliot: "He should receive [on appointment] as assistant professor a salary which will enable him to support a wife and two or three children comfortably, but without luxuries or costly pleasures. It is well to have the appointment of assistant professor given for a fixed term of years, as, for example, five. If, at the end of his first term as assistant professor, a second appointment with the same title be given, a moderate advance of salary should accompany the second appointment. By the time the end of a second term as assistant professor is reached, the candidate for further employment in the university will be approaching forty years of age, and is ready for a full professorship" ("University Administration," p. 13). The age of appointment averages 31.25 years. Two five-year terms bring him to 41.25.

is thrown on the question, and on that of standard of living, by the following replies to the query whether the total income was sufficient, or whether they were running behind. The answers are here set down exactly in order of the tabulation. "Running even, with aid of fortunate real-estate venture on borrowed capital. Felt forced to do this." "Salary alone would not suffice to cover expenses of living with any manner of comfort." "Sufficient" (has private capital). "I keep even, but could not do it on my salary." "Can barely make both ends meet now" (in debt $1,000). "Ends compelled to meet under present method of living." "When debt incurred for study is paid, I think my income will do a little better than make both ends meet." (It would be cruel to shatter the hope. This is a young man, recently married, no children.) "Sufficient" (unmarried, supplements salary 25 per cent.). "Annual saving $500 on close living" (supplements salary 12 per cent.). "Must depend on outside sources." "Total just sufficient" (married, three children, salary $2,400). "Sufficient" (recently married). "Have had to earn outside to make income equal expenses." "Barely sufficient" (married, no children). "Running behind, $1,000 insurance recently abandoned, from inability to meet premiums" (married, two children, net indebtedness $1,094.70). "Just even with aid from other sources." "If I can keep expenses practically stationary, expect to pay debts in seven to ten years" (present indebtedness $2,053.50). "Both ends meet" (married, no children). "Have kept even, owing to remarkable freedom from sickness in family and to consistent self-sacrifice on the part of my wife." "It is against my principles to run behind, but neither can I get ahead on present salary ($1,350) or furnish necessary books and equipment to make my time count as it should." "Barely sufficient" (married, no children). "Can now make ends meet with difficulty." "Running behind a little" (present indebtedness $2,500). "Since marriage I have fallen behind." "Am making both ends meet, but it costs self-denial in buying books, etc." (married, no children, salary $1,200). "Salary would not support even my small family in ———. Saved a little when I wasn't teaching." And about forty more replies of the same tenor.

To complete the picture of the present financial status of these men: Seventeen men show an average net indebtedness of $1,019. The details are given in Table V.

TABLE V

Table of Net Indebtedness

	Amount	Single	Married	Children
1	$2,000.00		1	1
2	1,000.00		1	1
3	175.00		1	0
4	2,100.00		1	3
5	1,094.70		1	2
6	2,053.50		1	2
7	150.00	1		—
8	650.00		1	0
9	2,500.00		1	1
10	700.00	1		—
11	500.00		1	3
12	150.00		1	3
13	250.00	1		—
14	200.00	1		—
15[2]	600.00	1		—
16	1,500.00		1	0
17	1,700.00		1	3
	$17,323.20	5	12	

Average, $1,019.

Forty-three men show an average saving from salary of $1,765. The details are shown in Table VI. (From this table have been omitted two cases reported of saving from business ventures—one of $15,000 and one of $30,000.)

The remaining 52 report themselves as just even or make no comment. If we sub-

[2] Parents.

TABLE VI

Savings from Salary

	Amount	Single	Married	Children
1	$2,000 00	1		—
2	400.00		1	0
3	2,500.00		1	1
4	1,000.00		1	0
5	300.00	1		—
6	200.00		1	1
7	600.00	1		—
8	1,500.00		1	0
9	500.00	1		—
10	2,000.00	1		—
11	500.00		1	0
12	1,800.00	1		—
13	800.00		1	1
14	7,000.00		1	3[3]
15	800.00		1	2
16	2,500.00	1		—
17	1,200.00		1	3
18	650.00		1	1
19	1,000.00		1	1
20	1,500.00		1	0
21	2,000.00	1		—
22	3,000.00	1		—
23	7,000.00		1	0
24	5,000.00	1		—
25	3,500.00		1	2
26	300.00	1		—
27	750.00		1	0
28	4,000.00		1	0
29	6,000.00		1	7[4]
30	1,000.00		1	0
31	200.00		1	0
32	500.00		1	2
33	300.00		1	2
34	2,000.00	1		—
35	710.00		1	1
36	1,200.00	1		—
37	400.00		1	0
38	400.00	1		—
39	1,150.00	1		—
40	300.00		1	0
41	1,250.00		1	2
42	700.00	1		—
43	5,500.00		1	2[5]
Total	$75,910.00	16	27	

Average, $1,765.

tract the reported total deficit from the reported total saving from salary and divide by 112, the number of replies received, the average net saving per man for 10.3 years teaching service is $559.

Twenty-five carry no life insurance, 86 carry an average of $4,831. With a grim humor, one man who carries $6,000 insurance comments: "I seem to be worth more dead than alive." Nine report accident insurance in addition, an average of $4,445.

The table of savings from salary is scarcely less significant than that of deficits. Surely no demonstration is needed that the present scale of salaries in this rank is only sufficient to provide a modest living for a single man. Remember that the average salary during the ten years of service has been but $1,325, and the present salary for men of 37 years of age averages $1,800. The married men must supplement their income as best they may to make both ends meet—the salaries are insufficient to do it, on the scale of living demanded of them by their position and training.

Such divided efforts can not fail to affect not merely their further development, but their continuing efficiency. This problem of salaries is grave, and the possibility of readjustment worthy of most serious consideration by the administrative authorities. Particular attention may be called to the need for special consideration of those men in this rank who have passed their fortieth year—the possibly existing class of permanent assistant professors.

The rapid increase in the cost of living, in the past twenty years, has made the situation acute; for there has been no general increase of salaries commensurate with this, and as a consequence these men find themselves driven to a lower and lower standard of living. This is a grave menace to the efficiency of the institutions both present and future, for it must not be forgotten that the higher ranks must be recruited from time to time from men whose development has necessarily been limited by the conditions surrounding this rank.

Stanford University Guido H. Marx

(To be continued)

[3] Not a college graduate.

[4] Salary, $4,000

[5] Salary, $2,250. Supplemental, 30 per cent.

THE PALEONTOLOGIC CORRELATION THROUGH THE BACHE FUND

IN 1908 the National Academy of Sciences appointed a committee on comparative research in paleontological correlation with power to add foreign and American associates to their number. The committee was divided into vertebrate and invertebrate sections. The vertebrate section organized with the following members: Professor H. F. Osborn, of Columbia University and the U. S. Geological Survey, chairman; Professors Scott, of Princeton University; Dollo, of Brussels University; Deperét, of Lyons University; Fraas, of Stuttgart University; Koken, of Tübingen University; von Huene, of Tübingen University; Williston, of the University of Chicago. Associated for special subjects: Professor J. C. Merriam, of the University of California; Dr. R. Broom, of Victoria College, Stellenbosch; Dr. Santiago Roth, of La Plata, Argentina; Dr. W. D. Matthew, of the American Museum of Natural History, secretary.

The trustees of the Bache Fund of the National Academy of Sciences through Professor Charles S. Minot, secretary, appropriated $500 for the work of the committee during the year 1909, and recently made a second appropriation of $500 for the year 1910. The fund is used partly to defray the expenses of correspondence, chiefly to direct investigation and secure special reports from various members of the committee and others.

The council of the New York Academy of Sciences in 1909 generously offered to cooperate with this research by the publication of the series of bulletins reporting progress. These bulletins are partly published and illustrated with the aid of the Bache Fund. They are as follows: Bulletin No. 1, "Plan and Scope," by Henry Fairfield Osborn and W. D. Matthew; Bulletin No. 2, "Fossil Vertebrates of Belgium," by Louis Dollo, translated by W. D. Matthew; Bulletin No. 3, "Patagonia and the Pampean Formation," review of correlation of Santiago Roth, with lists of characteristic species and provisional systematic references, by W. D. Matthew.

The chairman of the committee has devoted his entire time (1909) to the preparation of a book entitled "The Age of Mammals," in which the results of his researches upon the correlation of the Tertiary and Quaternary periods, and the development and succession of mammalian faunas during the Cænozoic are set forth more fully and completely than in previous publications, and with as broad and popular a treatment as the subject permits.

The secretary has prepared a series of faunal lists of the Tertiary mammals of North America, on the lines laid out in the preliminary bulletin entitled "Plan and Scope" (p. 45). The object of these elaborate and extended lists is to enable correlators to "get behind the record," to enable them to critically consider each faunal list, to estimate the weight of evidence afforded by each species listed. In such an estimate the exact level and locality, the authority and date of description, the perfection or imperfection of the types, their location (to facilitate reexamination) are always essential factors; and such other data as may seem of value are given in the annotations. Mere lists of species without such data behind them are apt to be confusing and misleading. The results attained in correlations based upon bare lists of species are almost always a summary or average of discordant data. The best that can be hoped for will be that it will be a fair average; and where a preconceived bias exists on the part of the workers in a particular region, it will often be so manifestly incorrect that the results are generally rejected, and the entire subject of correlation discredited by them. Discordance in the evidence we take to be a proof that there is somewhere an error. The publication of these lists with complete data as to each species recorded, and with sections, lists of principal publications and annotation of various kinds, will assist, it is hoped, in locating and eliminating such errors.

Dr. Matthew has also in preparation lists of all the American vertebrate faunæ, with such data as could be readily obtained. These are now completed down to the year 1900. They will be submitted to the several authorities in

charge of different periods for the addition or completion of data, and annotations and geological sections as outlined in the preliminary bulletins. With similar data from foreign horizons these will form a broader and more permanent basis for exact correlation than has hitherto been available.

The general interest that has recently been aroused among students of fossil vertebrata is attested by the appearance of a number of important papers dealing with the more exact correlation of formations in which fossil vertebrates are found. Important additions to the evidence as to the position of the Mesozoic and Cænozoic formations of the Argentine by Ameghino, Roth, Scott, Ortmann, Hatcher and Sinclair have in recent years advanced this difficult problem a long way toward solution. The recent work of J. C. Merriam in California, Oregon and Nevada has been of the highest quality and great importance in correlation of the Pacific slope and other sections of this continent. Von Huene's investigations in the European Triassic, Broom's studies upon the South African Permian and Mesozoic, have already gone far toward clearing up these great problems in correlation. These are cited but as examples of the spirit of thorough, exact and progressive method in which many investigators are carrying on the work, each in his special province.

Correlation of more or less importance is contained in the series of papers published within the last year by Osborn, Matthew, Douglass, von Huene, Knowlton and Broom.

During the coming year the secretary of the committee will devote himself to the preparation of correlation lists for the North American Tertiary and for the North American pre-Tertiary. Data will be prepared for the North American Cretaceous and Cretaceous-Eocene contact by Osborn and Brown. The committee has promised also a number of American and foreign pre-Tertiary faunal correlations by members and associates.

Inquiries should be addressed to W. D. Matthew, American Museum of Natural History, New York.

THE INTERNATIONAL AMERICAN CONGRESS OF MEDICINE AND HYGIENE

The International American Congress of Medicine and Hygiene of 1910 in commemoration of the first centenary of the May revolution of 1810, under the patronage of the president of the Argentine Republic, will be held May 25, in Buenos Aires, Argentine Republic.

In order to facilitate the contribution of papers and exhibits from the United States, there has been appointed by the president of the congress, Dr. Eliseo Cantôn, and the Minister of the Argentine Republic at Washington, a committee of propaganda, of which Dr. Charles H. Frazier (Philadelphia, Pa.) is chairman and Dr. Alfred Reginald Allen (Philadelphia, Pa.) is secretary.

The congress has been divided into nine sections, each section being represented in the United States by its chairman in this committee of propaganda as follows:

Section 1—Biological and Fundamental Matters, Dr. W. H. Howell, chairman, Baltimore, Md.
Section 2—Medicine and its Clinics, Dr. George Dock, chairman, New Orleans, La.
Section 3—Surgery and its Clinics, Dr. John M. T. Finney, chairman, Baltimore, Md.
Section 4—Public Hygiene, Dr. Alexander C. Abbott, chairman, Philadelphia, Pa.
Section 5—Pharmacy and Chemistry, Dr. David L. Edsall, chairman, Philadelphia, Pa.
Section 6—Sanitary Technology, Dr. W. P. Mason, chairman, Troy, N. Y.
Section 7—Veterinary Police, Dr. Samuel H. Gilliland, chairman, Marietta, Pa.
Section 8—Dental Pathology, Dr. George V. I. Brown, chairman, Milwaukee, Wis.
Section 9—Exhibition of Hygiene, Dr. Alexander C. Abbott, chairman, Philadelphia, Pa.

It will not be necessary for one contributing a paper or exhibit to the congress to be present in person. Arrangements will be made to have contributions suitably presented in the absence of the author. The official languages of the congress will be Spanish and English. Members of the following professions are eligible to present papers or exhibits: Medicine, pharmacy, chemistry, dentistry, veterinary medicine, engineering and architecture.

Papers may be sent direct to the chairman of the particular section for which they are intended, or to Dr. Alfred Reginald Allen, Secretary, 111 South 21st Street, Philadelphia, Pa.

THE ELIZABETH THOMPSON SCIENCE FUND

THE thirty-fifth meeting of the board of trustees was held in Boston, Mass., on February 2, 1910.

The following officers were elected:

President—Edward C. Pickering.
Treasurer—Charles S. Rackemann.
Secretary—Charles S. Minot.

The secretary stated that during the past year no reports had been received from the following holders of grants: 22, 27, E. Hartwig; 107, M. W. Travers; 117, E. Salkowski and C. Neuberg; 123, E. C. Jeffrey; 131, F. W. Thyng; 134, C. L. Alsberg.

The reports received from the following holders of grants were accepted as reports of progress: 98, J. Weinzirl; 109, A. Nicolas; 111, R. Hürthle; 119, J. P. McMurrich; 121, E. Debierne; 124, P. Bachmetjew; 133, J. F. Shepard; 136, H. Z. Kip; 137, C. H. Eigenmann; 138, Mme. P. Šafarik; 140, K. Guthe; 141, J. P. Patterson; 142, W. J. Hale; 144, G. A. Hulett; 146, M. Nussbaum; 147, J. Müller; 148, C. C. Nutting; 149, P. A. Guye; 152, W. D. Hoyt; 154, J. P. Munson.

It was voted to close the accounts of the following grants: 135, A. Negri; 139, J. Koenigsberger; 145, J. de Kowalski; 151, O. von Fürth; 153, W. Doberck, and to close upon receipt of publications the account of grant 143, awarded to Professor R. W. Wood.

The secretary stated that a fifth publication had been received from Professor E. Wiedemann, acknowledging the aid obtained through grant 127.

The trustees greatly regretted to be obliged to decline several applications which were highly deserving of aid.

It was voted to make the following new grants:

155. $300 to Dr. H. P. Hollnagel, Berlin, Germany, for a redetermination of the longer wave-lengths in the extreme infra-red portion of the spectrum, by an interferometer method.

156. $100 to Professor R. Thaxter, Cambridge, Mass., for further studies on the Laboulbeniaceæ.

157. $100 to Dr. L. Mercier, Nancy, France, to study the bacteria living symbiotically within various invertebrates.

158. $50 to Professor H. V. Neal, Galesburg, Ill., for a study of nerve histogenesis in *Squalus acanthias*.

159. $100 to Dr. B. M. Davis, Cambridge, Mass., for cytological and genetical studies on native species of Oenothera.

160. $50 to Dr. L. J. Henderson, Boston, Mass., for a research upon the use as indicators of aromatic nitro compounds which contain phenolic hydroxyl groups, or amino groups, or carboxyl groups.

161. $100 to Professor O. von Fürth, Vienna, Austria, for further studies on internal secretion.

CHARLES S. MINOT,
Secretary

SCIENTIFIC NOTES AND NEWS

INVITATIONS for the centennial celebration of the University of Berlin, to be held in October of this year, have been sent to the visiting professors who have represented Harvard University and Columbia University at the University of Berlin. These include Professors Theodore W. Richards and W. M. Davis, of Harvard University.

THE official delegation from the Geological Society of America to the eleventh International Geological Congress to be held at Stockholm, Sweden, in August of this year has been constituted as follows: Arnold Hague, Sc.D., U. S. Geological Survey, president of the Geological Society of America; Charles R. Van Hise, LL.D., University of Wisconsin; James F. Kemp, professor of geology, Columbia University; Frank D. Adams, D.Sc., dean of the faculty of applied science, McGill University, and Edmund Otis Hovey, Ph.D., curator of geology and invertebrate paleontology, American Museum of Natural History.

PROFESSOR HUGH D. REED has been appointed delegate from Cornell University to

the eighth International Zoological Congress at Gratz.

Sir Victor Horsley, F.R.S., has been elected a foreign associate of the French Academy of Medicine.

The faculty of the Agricultural College of the University of Minnesota has given a dinner in honor of Dr. A. F. Woods, the new dean of the college.

Professor W. B. Gregory, of Tulane University, has been elected president of the Louisiana Engineering Society.

The British secretary of state for the colonies has appointed Mr. W. D. Ellis, of the Colonial Office, to be a member of the advisory committee on medical and sanitary questions connected with the British colonies and protectorates in Tropical Africa.

At the Lister Institute of Preventive Medicine, London, Mr. H. R. Dean and Dr. G. H. Macalister have been appointed assistant bacteriologists and Dr. H. McLane, senior assistant in the biochemical department.

Dr. W. F. Hume has been appointed director of the Geological Survey of Egypt.

Dr. Walter Knoche, of Berlin, has been appointed director of the newly established Meteorological and Geophysical Institute of Chili, and at the same time professor of meteorology in the University of Santiago.

Professor James H. Tufts, of the University of Chicago, is giving at the Johns Hopkins University a course of ten lectures on modern problems of metaphysics and the theory of knowledge.

M. Emil Boutroux, professor of philosophy at the Sorbonne, Paris, is now lecturing at Harvard University on the Hyde foundation.

Dr. H. E. Crampton, professor of zoology at Barnard College, Columbia University, and curator of invertebrate zoology at the American Museum of Natural History, lectured at Vassar College, on March 9, on "Exploring the Islands of the South Seas."

Professor S. A. Mitchell, of Columbia University, on March 4 and 11, delivered lectures in Philadelphia on "Halley's Comet."

President Charles R. Van Hise, of the University of Wisconsin, is to deliver one of the principal addresses on the conservation of natural resources at the first Minnesota Conservation and Agricultural Development Congress, in St. Paul, Minn., March 16 to 19.

At the annual dinner of the Harvard Teachers' Association, on March 12, addresses on "The American College" were made by Professor J. McKeen Cattell, of Columbia University, and President A. Ross Hill, of the University of Missouri.

Sir J. J. Thomson will give the evening discourse at the Royal Institution on March 18, on the dynamics of a golf ball.

We learn from the *Geographical Journal* that a monument to the French navigator, Bougainville, has been inaugurated, with appropriate formalities, at Papeete, on the island of Tahiti, which island he visited a few months after its discovery by the English navigator Wallis. The proposal for the erection of the monument emanated from a French colonial official, a member of the Paris Geographical Society, by which body it was taken up with enthusiasm. The bust erected at Papeete was in part a copy of that in the possession of the Paris Society, but portraits preserved in the navigator's family were also utilized by the sculptor. The scheme received the support of the French government as well as of the municipality of Papeete, and the ceremony of inauguration was opened by a speech by M. François, governor of French Oceania. Two French and two British warships were present on the occasion.

Dr. J. A. Bergström, professor of pedagogy at Stanford University, previously professor of pedagogy and director of the psychological laboratory at the University of Indiana, died on February 28, at the age of forty-two years.

Dr. Charles F. Wheeler, botanical expert in the Bureau of Plant Industry, U. S. Department of Agriculture, formerly assistant botanist in the Michigan Agricultural College, died March 5, 1910, at the age of sixty-eight years.

THE death is announced, at the age of thirty-three years, of Mr. J. F. Ferry, known as an ornithologist, who had been connected with the Field Museum of Natural History and the U. S. Biological Survey.

MR. EDWARD SAUNDERS, F.R.S., eminent for his contributions to systematic entomology, died on February 6, in his sixty-second year.

M. PHILLIPPE THOMAS, known for his geological work in northern Africa, has died at the age of sixty-seven years.

DR. ARTHUR BORDIER, professor of natural history at the medical school of Grenoble, has died at the age of sixty-nine years.

THE scientific societies and universities of Australia are, as we have already noted, taking steps to arrange that the British Association for the Advancement of Science shall visit Australia in 1913 or 1914. An influential deputation, at the head of which was Sir John Madden, chancellor of Melbourne University, waited on the federal prime minister recently with a request for a federal guarantee up to the sum of £10,000. The prime minister is said to have expressed his personal approval.

A BILL has been introduced in the Ohio senate to appropriate $1,000 to organize and equip a Pasteur Institute for the treatment of hydrophobia at the Ohio State University, Columbus, and to appropriate $1,000 annually for maintenance.

IT is reported that Mr. Andrew Carnegie has offered to give a prize of $25,000 to the first student of the Carnegie School of Technology, of Pittsburgh, who will construct an aeroplane satisfying certain conditions.

THE trustees of Mr. Otto Beit's gift of £215,000 for the foundation and endowment of medical research scholarships met on February 23, and awarded the first set of the fellowships. *Nature* states that seventy applications were received—fifty-eight from England, three from Scotland, one from Ireland, one from Wales and seven from abroad. The following fellows were elected, and were authorized to proceed with the researches mentioned after their names: Mr. G. H. Drew, the zoological distribution of cancer and a systematic study of an experimental character on the mode of origin of neoplasms (tumors); Dr. F. W. Edridge-Green, various problems connected with vision and color-vision, especially in relation to the correct reading of signals on land and sea; Mr. E. Hindle, the morphology and treatment of protozoic blood parasites, especially *Sporochæta duttoni* and trypanosomiasis (sleeping sickness); Dr. T. Lewis, the mechanism of irregularities of the heart; Dr. G. C. McKay Mathison, (*a*) the nervous control of respiration and (*b*) the effect on respiration of changes in the chemical composition of the blood; (*c*) the mechanism of biliary secretion and its general effect in digestive processes; Dr. Otto May, clinical and experimental research on the lesions of peripheral nerves; Mr. E. Mellanby, the significance of the large excretion of creatin in cancer of the liver and its diminished excretion in cirrhosis of the liver, etc.; Dr. F. P. F. Ransom, the mode of action of caffeine, theobromine and allied substances on the muscular and nervous systems; Dr. S. Russ, the association of radioactivity with cancer; Dr. Ida Smedley, the processes involved in the formation of fat in the organism. The next election of fellows will be held about December 15 next. All inquiries should be addressed to the honorary secretary, Beit Memorial Fellowships for Medical Research, 35 Clarges Street, Piccadilly, London, W.

THE second session of the Biological Station of the University of Michigan will begin July 5 and continue for eight weeks, closing August 26, 1910. The station is located on the shores of Douglas Lake, Cheboygan County, in northern Michigan, and is particularly well located for field and laboratory courses in zoology and botany. The work of the station is under the supervision of Professor Jacob Reighard, head of the department of zoology in the University of Michigan, as director. The active staff will consist of Dr. A. S. Pearse, instructor in zoology in the University of Michigan and assistant director of the Biological Station; Assistant Professor Raymond J. Pool, of the

department of botany of the University of Nebraska and director of the Nebraska State Botanical Survey; Mr. Norman H. Stewart and Miss Lucie Harmon, assistants in zoology in the University of Michigan; Mr. F. A. Loew, professor of science in Central College, Indiana, will act as assistant in botany. The courses of instruction will include: the natural history of invertebrate animals, field studies in vertebrate zoology, zoology for teachers, special work in research in zoology, first course in field and forest botany, mycology, systematic botany of seed plants, advanced work in research in botany.

A REPORT on the feldspar deposits of the United States, by E. S. Bastin, has just been published by the United States Geological Survey as its Bulletin 420. The feldspars are among the most widely distributed minerals and are constituents of nearly all rocks. The decomposition of feldspar has yielded a large part of the clay of the soil; also the mineral kaolin, an essential material for making fine pottery. Most of the commercially valuable feldspar now mined is obtained from rocks known as pegmatites, the commonest variety of which is essentially a very coarse granite. Feldspar is mined and ground for use mainly by potters, but a portion of the product is used in the manufacture of emery and other abrasive wheels, to bind the abrading particles together, and small quantities are employed in making opalescent glass, scouring soaps, roofing material and poultry grit. Feldspars that are rich in potash are now the subject of experiments made to determine their value as fertilizers. The principal feldspar quarries in the United States are in New England and the middle Atlantic states, and the annual value of the product is now about half a million dollars. Mr. Bastin discusses the chemical and physical character of the feldspars, their geologic occurrence and origin, and the methods of mining and milling, and describes in detail the deposits worked at the numerous quarries.

THE annual report for the year 1909 of the Philosophical Institute of Canterbury, New Zealand, presented to the annual meeting held last December, is abstracted in *Nature*, which states that during the year the publication of the results of the expedition to the sub-Antarctic islands of New Zealand was steadily proceeded with under the editorship of Dr. C. Chilton. The reports upon the work will consist of two quarto volumes of about 400 pages each, and will be illustrated with numerous plates (some colored), photographs and text-figures; they will be accompanied by a large colored map of the Antarctic and sub-Antarctic regions, showing the ocean depths as ascertained by recent expeditions. Work in botany has been carried on by Dr. Cockayne during the past two years. Although a great deal has been done in the way of establishing sanctuaries and national parks in order that the native fauna may be preserved for all time, the importance of placing on record their present ecological condition can hardly be overestimated. It is hoped that at some early date the government may see its way to authorize Dr. Cockayne to proceed further with the botanical survey of the Dominion. Largely owing to the representations of the institute, combined with those of the Otago Institute, the position of the memorial to the late Sir James Hector has been made satisfactory. Owing to the action of the government in granting a generous subsidy, ample funds will be at the disposal of the committee for establishing a memorial that will be worthy of Sir James Hector's long and distinguished service to the cause of science in New Zealand. Observations in connection with the Arthur's Pass Tunnel were continued throughout the year. Temperature readings have been taken every ten chains and specimens collected. Early last year a committee was formed for the purpose of investigating systematically the artesian system of Christchurch and the neighborhood. The committee has held several meetings, and has taken preliminary steps for ascertaining the extent, depth and geological relations of the water-bearing strata, and for the examination of physical, chemical and biological properties of the water obtained from them. Two papers by Dr. Farr and Mr. D. C. H. Florance, on the radium emanation con-

tained in the artesian water and on the effect of the water as it comes direct from the well on trout and other fish, have already been laid before the institute. A committee was appointed to consider the Animals' Protection Act, and to suggest amendments with the view of giving more effective protection to the native fauna of the Dominion. A conference was held with a similar committee appointed by the Canterbury Acclimatization Society, and a number of recommendations were made which received the approval of the council. It is intended to submit the proposals to other institutes for their consideration, and if they meet with approval to bring the matter under the notice of members of parliament and of the minister for internal affairs. It is hoped later to send a party to the Chatham Islands for purposes of scientific investigation.

IN reclaiming the Great Valley of California the removal and control of mining débris in the rivers play a very important part. It is estimated that the bed of Yuba River alone contains three hundred million cubic yards of this débris. By these deposits the low-water stage of this stream was raised 15 feet at Marysville between 1849 and 1881, and the stream bed near this place is now 13 feet above the level of the surrounding farm land, so that it has been necessary to build large dikes or levees along the river. For four years the United States Geological Survey has been studying this débris problem, as it has been called, and in connection with the study a hydraulic laboratory was built at the University of California, Berkeley, Cal., for the experimental investigation of the laws of transportation of sand and gravel by water. This investigation has outgrown the narrow limits of the laboratory, and it is proposed to continue this work on a much larger scale in connection with one of the projects of the United States Reclamation Service. In a preliminary report now in preparation the apparatus and methods employed will be described and the results obtained will be discussed in detail. The results will be expressed by formulas and represented graphically by curves. Relations connecting the discharge, slope and load will be given for eight sizes of sand and gravel and for artificial and natural mixtures. The experiments include stream transportation, in which the stream bed is sand or gravel—a self-made bed—and flume transportation, in which the bed is wood or metal, as in sluicing. The accuracy and the applicability of the results to practical problems will be discussed and the data that have only an indirect bearing on the débris problem will be presented in three appendixes. If means are provided for the use of the larger apparatus and the much larger water supply that will be available in connection with the reclamation project some of the data thus far obtained will be tested and the relations connecting the factors of transportation will be extended so as to make them more directly applicable to problems of stream control and economic sluicing.

UNIVERSITY AND EDUCATIONAL NEWS

COLUMBIA UNIVERSITY has received an anonymous gift of $350,000 for the erection of a building for the faculty of philosophy, which has charge of the graduate work in philosophy and languages. The university has also received anonymously $15,000 for work in agricultural education.

A ZOOLOGICAL laboratory is to be erected at the University of Pennsylvania, at a cost of about $250,000. In making the announcement on university day, Provost Harrison stated that it would be "the most complete biological laboratory yet erected."

BY the will of Mrs. Mary A. Richardson, Tufts College receives $40,000 for fellowships.

AT Columbia University William B. Fite, Ph.B. and Ph.D. (Cornell), professor of mathematics at Cornell University, and H. E. Hawks, A.B. and Ph.D. (Yale), assistant professor of mathematics at Yale University, have been appointed professors of mathematics. George B. Wendell, B.S. (Massachusetts Institute), Ph.D. (Leipzig), professor in the Stevens Institute, has been appointed professor of physics. Charles H. Burnside, of the University of Wisconsin, has been ap-

pointed assistant professor of mathematics. Dr. Charles Lane Poor, professor of astronomy in Columbia University, has been transferred to a chair of celestial mechanics.

At Cambridge University Dr. E. W. Hobson, F.R.S., fellow at Christ's College, has been elected Sadlerian professor of pure mathematics.

DISCUSSION AND CORRESPONDENCE

THE RETROSPECTIVE ANTICIPATIONS OF THE CARNEGIE FOUNDATION

To the Editor of Science: The fourth annual report of the president of the Carnegie Foundation, the most important part of which is published in your issue of February 25, is marked by one feature which seems scarcely less sinister than the breach of faith on the part of the foundation which was discussed in my remarks printed in the same issue.

The rules for the granting of service pensions by the foundation, as promulgated in the first annual report, and as explained in the statements of the president at that time and subsequently, contained no word indicating that these pensions were to be regarded as disability pensions. In the federal charter of the corporation, moreover, as well as in many other expressions of the purpose of the foundation,[1] service, old age and disability pensions have always been specifically distinguished. The first annual report contains, further, the following statement (page 37):

> To better the profession of the teacher, and to attract into it increasing numbers of strong men, it is necessary that the retiring allowances should come as a matter of right, not as a charity. No ambitious and independent professor wishes to find himself in the position of accepting a charity or a favor, and the retiring allowance system, simply as a charity, has little to commend it. It would unquestionably relieve here and there distress of a most pathetic sort, but, like all other ill-considered charity, it would work harm in other directions. It is essential, in the opinion of the trustees, that the funds shall be so administered as to appeal to the professor in American and Canadian colleges from the standpoint of a right, not from that of charity, to the end that a teacher shall receive his retiring allowance on exactly the same basis as that upon which he receives his active salary, as a part of his academic compensation.

These early announcements of the foundation have been generally construed by the profession, in their natural sense, as implying that both service and old-age pensions were to be regarded as a form of deferred salary, earned by the previous service of the recipients, and not presupposing on the part of the recipients either destitution or disability. Acting upon this understanding, some twenty-eight gentlemen,[2] who were not physically incapacitated, and who apparently made no pretension to being either "pathetic cases" or "geniuses," accepted service pensions.

The trustees of the foundation have now determined to abolish all service pensions as such, and to substitute therefor a system of disability pensions. The new report of President Pritchett accordingly reads back into the past intentions of the foundation its present purpose, and makes it appear that the service pensions were, from the start, designed essentially for disabled teachers. The new report contains the following passage, which should be compared with that just quoted from the first report. The original Rule II. was adopted to make

> provision for teachers, who, after long service, have become broken in health, or who, by physical infirmity, such as loss of hearing, are incapacitated for their calling. Among the most pathetic cases in the profession of the teacher, and those most embarrassing to the colleges, have been ones in which teachers have, often after faithful service, broken in health and found themselves with approaching age practically helpless.

The same rule was in a minor degree also intended to provide for "the rare cases which now and then arise when a man of real genius as a scholar might prefer to accept a smaller pension and devote himself exclusively to productive work in science or literature." The president of the foundation quotes verbatim the original service pension rule (which says nothing whatever about disability) and immediately adds the surprising comment, "the second rule thus became a complex one, covering service and disability." (It may be noted

[1] *Cf.* especially First Report, p. 14.

[2] Fourth Annual Report, p. 72.

that the word "disability" was already to be found in ordinary English dictionaries in the year 1906.) "It was believed," says President Pritchett, "that the number of teachers who would avail themselves of retirement under such conditions would be confined almost exclusively to those who were physically impaired."

In accordance with this retroactive construction of the original rules and announcements—a construction nowhere sanctioned by anything in the language of them—the president of the foundation reflects severely upon the twenty-eight persons who, without disability, accepted service pensions.

> The expectation that this rule would be taken advantage of almost wholly on the ground of disabilities has proved to be ill-founded. . . . The correspondence . . . indicates that a number of teachers have persuaded themselves that they are specially intended for research. Some of these have a small income, which, even with the minimum pension, promises a safe, if not ample, support. Others are "tired of teaching." It seems that this rule offers too large a temptation to certain qualities of universal human nature.

From this and other recent statements it appears not only that no one is assured of actually receiving the retiring allowances which the foundation by its rules at any given time announces it will grant, but also that those who are granted pensions upon terms which seem to be clearly understood, and to be sanctioned by the foundation at the time, may thereafter be subject to censure from the president of the foundation for having taken the pensions which were offered them. This is not a situation wholly calculated to increase the attractiveness of the foundation's pension system, or "to dignify and strengthen the calling of the teacher."[2] It certainly affords conclusive evidence, which should be pondered by professors and governing boards in "accepted institutions," that the apparently plain language of the foundation's rules gives no clue whatever as to what the officials of the foundation may subsequently announce that they have previously been anticipating.

[2] First Report, p. 31.

The recent report also mentions, among the chief reasons for the abolition of the service pension, "the tendency of the teacher assured of a retiring allowance to become ultra-critical toward the administration" of his university. This seems to mean, if it means anything, either that an important proportion of the members of the profession are kept in order only through their fear of losing their positions, and that, if assured of an independent competency, they would forthwith behave in an unreasonable manner; or else it means that, whether the criticism that might proceed from professors were reasonable or not, they should, in any case, be kept silent and subservient by a mild form of terrorism. I can not think that the publication, by a person holding the position of the president of the Carnegie Foundation, of such views as this concerning the average character and self-respect and the proper status of the members of our profession, is likely to improve the public standing of that profession. There seems to be grave reason to conclude that it is time for the rank and file of the teaching body to demand that the management of the Carnegie Foundation shall be altered in whatever manner is necessary in order to protect them against the sort of deception and the sort of indignity to which they have been subjected in the recent administration of this potentially beneficent institution.

ARTHUR O. LOVEJOY

COLUMBIA, MO.

THE NORWOOD "METEORITE" A FRAUD.[1] HOW METEORITIC EVIDENCE MAY BE MANUFACTURED

TO THE EDITOR OF SCIENCE: As a result of continued investigation of the supposed Norwood "meteorite," I am now able to state definitely that the whole thing is a cunningly devised fraud. In order that investigators may be on their guard against similar deceptions, it seems to me desirable to put the facts on record. I will first state the apparent facts.

[1] See SCIENCE, N. S., Vol. XXXI., No. 787, January 28, 1910, pp. 143 and 156.

Mr. Herbert S. Winslow, who is a trained hunter with excellent powers of observation, was standing near Walpole Street, a little beyond Chapel Street, in Norwood, and had an unobstructed view of the western sky in a quiet country neighborhood. He was looking upward and saw a brilliant object appear in the west at an altitude of about 60°. It fell slowly at first, then quite rapidly, disappearing behind some distant pine trees in a direction a trifle north of west in about 7 seconds. There was an increase in apparent size in the ratio of not over 3 to 1. The brightness varied in a somewhat larger ratio. The object was pear-shaped, sharply pointed at the advancing (lower) extremity, but rounded above, about twice as long as broad and as large as the moon, brightest at the margins, and of an orange-red color. It moved with a wavy, serpentine motion, and gave off numerous white sparklets on either side, about as bright as Polaris. These sparklets faded out before traversing a distance greater than the length of the main body. The object fell in the direction of the Nickerson farm, distant 0.8 miles, and was different from an ordinary shooting star. Its considerable angular dimensions imply a flaming mantle of incandescent vapor. The time was 6:42 P.M., October 7, 1909. Other observers in Norwood confirmed enough of these statements to make the fact beyond dispute; but, singularly, I could find no witnesses from surrounding towns after assiduous search.

The motion having been very slow at first, but rapid at the end, the appearance was not inconsistent with the supposition that the object might have been advancing at first nearly end-on, and that the path then curved rapidly into a vertical direction—a motion of which there was good evidence in the fall of a 33-pound meteorite at Krähenberg in Bavaria, May 25, 1869, which is said to have "entered the ground to a depth of from three to four feet, making a perfectly vertical hole"; but from observations at neighboring places, "the inclination of the path of the meteor to the horizon is computed to have been 32°."[2]

[2] Dr. Flight, "History of Meteorites," p. 5.

The serpentine motion is sometimes witnessed in shooting stars. I have never seen *white* sparklets from an *orange*-colored meteor, although I have witnessed the fading of exploded fragments of a brilliant white meteor through yellow and orange to red. The fall of a bolide without noteworthy sound is exceptional, but not unprecedented. Ordinarily, the noises are very loud, often "terrific."

The following coincidences are to be noted:

1. An object not unlike a fire-ball was seen to fall in a given direction.

2. At a point in this direction, and within a few hours after the occurrence, a farm hand who knew nothing about the fire-ball, found that a set of bars had been unaccountably broken at some time during the previous night.

3. A peculiar, large and heavy stone—an ophitic andesite porphyry, entirely different from the glacial boulders of the vicinity—a stone quite competent to smash the bars if fired through them with the velocity of a cannon shot, but not able to do the damage if it had been merely dropped from a height of a few feet, was found directly under the break, according to the statement of Mr. W. P. Nickerson, the owner of the farm.

4. The stone had apparently penetrated deeply into the soft sand, as if it had dropped with great velocity.

5. On being pried out of the sand, the lower and better protected end of the stone, which would naturally be the advancing end, was found to be still hot (statement of the farmer, confirmed by workmen, and by an unprejudiced neighbor).

6. The sand around the stone was dry, whereas the surrounding earth was moist, on authority of Mr. Nickerson.

The peculiar composition of the stone, while distinguishing it clearly from local boulders, equally differentiated it from all known aerolites, and was a distinct difficulty in the way of accepting the stone as a meteorite. I at first thought that this difficulty might be met, the absence of an external vitrified coat being attributable to a description of the ground-mass of which the sparks might have been an

evidence, and was more impressed by the fact that the disturbance of the ground at the point of impact was not as great as I should have anticipated. So far, the evidence, though puzzling, seemed too strong to be summarily rejected.

A diligent search of the surroundings and an excavation which I made at the supposed point of impact to a depth below all previous disturbance, had failed to reveal any other stone of a meteoritic nature. The composition of the specimen was quite different from that of neighboring dike rocks, and was absolutely unlike the vast majority of granite, diorite, and dark, banded, or concretionary felsitic boulders of the local glacial drift. The surfacing was such as a water-worn boulder of its composition might receive, if it had lain for a long time in a peat bog, where the fine-grained ground-mass could be disintegrated, leaving the phenocrysts protruding. The actual site, however, was not of this description, but was on the sloping border of a dissected sand-plain, some twenty to thirty feet above the neighboring valley.

Now for the real facts: It appears that the proprietor of a cheap vaudeville show in Boston, purchased the "meteorite" from a Vermont man. It was said to have "fallen" in New Hampshire. The new owner seems to have thought it necessary to work the thing up and give it "local color." Accordingly, the stone (previously heated?) was taken to Norwood in an automobile, by night, and deposited on the farm of Mr. Nickerson, who was in the secret. I have talked with one of the employees of the dime-museum, who confessed that he was the man who broke the bars in the night. The next morning, Mr. Nickerson made an errand for one of the farm hands to the pasture (to hunt up a stray cow, or some such thing), the errand being so arranged that the man could not help finding the broken bars. On receiving the report of the occurrence, the farmer was apparently the most surprised man in town. Close questioning could not trip him.

I have been unable to ascertain how or when the stone was heated, nor do I know the secret of the fire-ball; but I suggest that the luminous appearance may have been produced in the following way: A large inverted rocket of suitable make, suspended from a (captive?) balloon, may have been sent up to a height of something over a mile, being provided with a time-fuse which burst the balloon and started the rocket downward at the same time. The farmer, in giving his version said: "My first idea was that the stone had been dropped from a balloon," showing that his mind was running on balloons. A vague story, insufficiently corroborated, has reached me, which implies that a similar bright object was seen in the same direction about four hours later on the same night, which possibly signifies that the rocket scheme was worked twice in order to make sure that the light should be seen by somebody not in the business, and whose testimony could not be impeached.

A few words in regard to the petrographical examination of the stone may be in order, since they may lead to an identification of the locality of an interesting specimen. It has every appearance of having been originally derived from an ancient terrestrial igneous rock which has been metamorphosed to some extent by hot mineral waters under heavy pressure, but shows little evidence of the action of mountain-building forces. Microscopic examination of a thin section shows that the material consists largely of labradorite feldspar arranged in ophitic structure. The clear greenish-white crystals appear entirely transparent in section, except for some trifling inclusions, namely, a few very minute crystals of yellow muscovite (sericite), and some irregular masses of pale brownish-yellow, lime-alumina garnet (grossularite). The corners of the feldspar crystals are mostly quite sharp, but a few are well rounded, as if they had suffered considerable attrition in the original magmatic flow. There are a few transverse fractures, but hardly any displacement. The edges of several crystals have been metamorphosed to albite. A measurement of the extinction angle on center and margin gives me: Lab.-Alb. $= -47° 55'$, in which, assuming an uncorrected albite angle of $+18°$, there

remains an uncorrected labradorite angle of $-29° 55'$. I apply to these proportional corrections, namely, for albite $+1°$, giving the true albite angle $= +19°$; and for labradorite a correction of $-1° 30'$, giving true angle $= -31° 25'$; which corresponds to a labradorite formula of albite 1, anorthite 4. A mean of the extinctions on opposite sides of a twinning plane in a typical labradorite crystal gave $-31° 18'$, which agrees with the previous determination of Ab_1An_4. The crystals, 1 or 2 mm. wide, and 5 to 10 mm. long, form a pretty closely parallel ophitic structure. A few crystals show Carlsbad twinning.

The ground-mass between the parallel feldspars is made up of a micro-crystalline mesh of the same material with very fine crystals (0.01 mm.) of a dark green pleochroic mineral, which appears to be biotite, and with equally minute crystals of magnetite, together with some titanite. The crushed mineral is almost entirely decolorized by boiling hydrochloric acid. Irregular larger masses of ilmenite with titanite borders, and masses of green biotite (1 to 2 mm. in diameter) in fine crystals, pleochroic with green and brown colors, complete the inclusions within the ground-mass. Dr. G. F. Loughlin, who helped me identify some of the minerals, is of the opinion that the rock has been "contact-metamorphosed, presumably by granitic intrusion, which set free heated water with potash and fluorine. These changed the original ferromagnesian minerals into biotite, and a little of the ilmenite and feldspar into titanite, garnet, sericite and secondary albite." The material is completely crystalline and has a decidedly fresh look, the fracture sparkling with minute crystalline facets.

Frank W. Very

Westwood, Mass.

The Norwood Meteorite (?)

As Professor Very, in Science of January 28, 1910, has seen fit to place on record the discovery of a stone claimed to be a meteorite, but unlike any meteorite hitherto known, a petrographic description of the stone may be of interest. The writer has discussed the matter with Professor Very, and at his suggestion, viewed the stone (on exhibition in Austin & Stone's Dime Museum), visited the spot where it was discovered and examined a thin-section which Professor Very furnished.

The stone may be called, megascopically, a basalt-porphyry. Its color on fresh fracture is nearly black, its luster rather dull. The ground mass is extremely fine-grained to felsitic. It is sprinkled with tabular phenocrysts of labradorite (about 30 per cent. of the rock) and with a few small grains of ilmenite. The natural surface is gray. There are no noticeable oxidation effects, but the ground mass has suffered marked corrosion, such as is produced by swamp waters, leaving the plagioclase phenocrysts in pronounced relief. The latter are greenish-gray, tabular with rounded corners and measure up to 12 or 15 mm. in length. They show in general a parallel arrangement, or flow structure.

The slight salty odor of the stone mentioned by Professor Very was not noted, but may well have been lost in the characteristic atmosphere of the dime museum.

The minerals noted in thin section are labradorite and ilmenite, both as phenocrysts and in the ground mass, biotite, titanite, garnet and sericite, with a little albite (?), epidote and kaolin. The ground mass consists chiefly of plagioclase and biotite. The labradorite phenocrysts show excellent Carlsbad and albite twinning. Both the phenocrysts and the feldspars of the ground mass are but slightly kaolinized, but are partially replaced by garnet, titanite and sericite. The garnet forms irregular grains fingering into the feldspar or the ground mass. The titanite forms rings around ilmenite grains, in some instances fingering into feldspar crystals. The sericite is sprinkled through the feldspar phenocrysts and the ground mass in typical minute flakes, single or in aggregates. The biotite is finely disseminated throughout the ground mass and in a few places is bunched into fine-grained aggregates, strongly suggesting replacement of some femic phenocryst. No trace, however, of any other femic mineral was noted. Only two small grains of

epidote, clearly of secondary origin, were found. The albite (?) could not be positively identified, but was clearly secondary.

The minerals and their associations just described indicate that the rock has suffered hydrothermal alteration, presumably near the contact of some plutonic intrusive. It therefore remains for the meteorite specialists to decide whether or not a newly fallen meteorite may be similar in mineral characters to hydrothermally altered terrestrial rocks. Professor Very's argument is that absence of pronounced kaolinization and ferruginous staining are good evidence that the stone is not a glacial boulder; but opposed to this argument is the fact of the corroded surface. The stone was discovered near the top of a gentle slope and certainly could not have become so corroded at that point. There is a swampy tract at the base of the slope. Could the stone have been corroded there and later been removed to the point of "discovery"?

Professor Very's argument that the stone is a meteorite is based, in short, partly on absence of kaolinization and ferruginous staining, but chiefly upon the verbal testimony cited in his article; the writer's argument to the contrary rests on the altered character evidenced by mineral relations, and the swamp-corroded surface, which coupled with the point of discovery, are at least suggestive of fraud.

G. F. LOUGHLIN

MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
February 8, 1910

QUOTATIONS

ANOTHER ROSS CASE

TEN years ago Professor E. A. Ross was dismissed from Leland Stanford University because Mrs. Stanford was offended by the active part he took in the campaign for free silver and by his extreme language in opposition to Japanese immigration. Last week he was publicly rebuked by the regents of the University of Wisconsin for exposing his students to the influence of dangerous agitators. The text of the resolution is as follows:

"Whereas, It has come to the knowledge of the Board of Regents that Professor E. A. Ross, of the department of sociology in our university, has invited to lecture in the university and under its auspices, persons whose record and expressed views are subversive of good morals, therefore be it

"Resolved, By the Board of Regents that we strongly disapprove of such action, and that the president of the university is requested to inform Professor Ross of the censure of the board and their unanimous disapproval of his indiscretions."

The disturbance originated in the visit of Emma Goldman to Madison, where she gave a lecture in a downtown hall in no wise connected with the university. She visited the university and was shown through it, but her request to be allowed to address classes was refused. Later, however, she was invited by a socialist club of students to speak at their meeting in the Y. M. C. A. building. Professor Ross, referring in his classes to the fact that a woman was tearing down the cards announcing the lecture, took occasion to express himself in favor of free speech and mentioned the Goldman lecture downtown that evening, at the same time stating his disapproval of such anarchistic teachings.

This, however, was made the basis of a sensational attack by certain newspapers of Wisconsin upon the university for using the facilities provided at the expense of the taxpayers for the promulgating of anarchistic and immoral doctrines. The Board of Visitors appointed a committee to examine instructors, students, lecture notes and textbooks in the department of political economy and came to the following conclusion:

"This investigation disclosed nothing that would warrant the charge that anarchistic, socialistic, or other dangerous doctrines are being taught in the university. On the contrary, investigation disclosed striking instances of foreigners who have come to the university as students believing in anarchism and violence, who have been led to discard such beliefs through the instruction given at the university.

"The general purpose of the instruction given was stated to be not to prove or disprove any particular theory or doctrine, but to enable the student to know and to understand facts and conditions; to fit him to solve for himself the problems of government and of society, rather than to send him forth with a solution for all the problems that he may encounter.

"The Board of Visitors finds that the instruction given in the university, including that given by Professor Ross, is such as to strengthen, not to weaken, respect for government and the institutions of existing society.

Evidently the Board of Regents takes a more serious view of the case than the Board of Visitors but they agree that Professor Ross has been indiscreet. So does Professor Ross, for in a letter to President Van Hise he frankly acknowledges that he should not have alluded to Miss Goldman's lecture in his classes and promises not to commit that sort of a mistake again. We hope, therefore, that he will not feel that the censure of the regents makes it incumbent upon him to resign, and we hope that the regents will not feel it necessary to impose any further restrictions on freedom of expression by members of the faculty.—*The Independent.*

SCIENTIFIC BOOKS

Researches on Fungi. An account of the production, liberation and dispersion of the spores of Hymenomycetes treated botanically and physically. Also some observations upon the discharge and dispersion of the spores of Ascomycetes and of Pilobolus. By A. H. Reginald Buller. London, New York, Bombay and Calcutta. Longmans, Green & Co. 1909.

For several years Dr. Buller has been engaged in studying the biology of certain species of Hymenomycetes with special relation to their response to external natural stimuli, to the mechanism of spore discharge, the velocity of spore fall, the adaptation of the spores for wind dispersal, and the correlation of the structure and development of the fruit bodies, with their adjustments, for the production and dissemination of spores. A few papers have already been published in the *Annals of Botany* and the *Journal of Economic Biology,* dealing with the biology and adjustments of *Polyporus squamosus* and *Lentinus squamosus* (*L. lepideus*), but the larger body of interesting results are here published for the first time. It constitutes a notable contribution to the biology of the fungi, especially in regard to the question of spore discharge and spore fall in the Hymenomycetes, and the remarkable adjustments of the plants which assure the dissemination of myriads of these minute reproductive bodies.

Under the influence of gravity the geotropic curvature of the stem of certain agarics has been shown by Dr. Buller to exhibit the same phenomenon of geotropic swinging or swaying which occurs in the shoots of seed plants. He first observed this in *Coprinus plicatilis* where there was an overtilting or supracurvature four times before it came to rest in the perpendicular position. *Coprinus plicatiloides* Buller, a very minute species growing on horse dung, is remarkably sensitive, one plant curving through 90° in 17.5 minutes. This species also shows geotropic swinging, the successive supracurvatures of the individuals mentioned being 28°, 8°, 1°, 0°.

It has long been known that gravity influences the direction of growth of the stem of many agarics, the stems being negatively geotropic, and the horizontal development of the pileus of many woody or corky species of the Polyporaceæ, the fruit bodies of these plants being diageotropic. These adjustments under the influence of gravity have been recognized as of the greatest importance in permitting the fall of the spores from between the closely approximated gills of most agarics and from the long narrow tubes of most polypores. Dr. Buller has now placed the interpretation of some of these phenomena on a sound experimental basis and has shown also the variations and limitations of the influence of gravity in relation to the adjustment of position of the different parts of the fruit body in

some half a dozen species. *A. campestris* responds in two ways to the influence of gravity —(1) the adjustment of the pileus in a horizontal position by the negatively geotropic stem, and (2) the finer adjustment of the gills by their positive geotropism. These two adjustments he speaks of as the coarse and fine adjustments, the positive geotropism of the gills placing them in a perpendicular position with reference to the earth in case the pileus should be slightly tilted from the horizontal.

Polyporus squamosus responds in four ways to the influence of gravity—(1) the negative geotropism of the stem after the initiation of the fruit body under the morphogenic influence of light, (2) growth of the pileus parallel to the earth's surface, (3) growth of the pileus with a symmetry suited to the position of the stipe, (4) growth of the hymenial tubes downward. *Agaricus campestris* is indifferent to light, while the fruit body of *Polyporus squamosus* is only initiated under the influence of light. The difference between the two species in the number of responses made to external stimuli, the author says, is correlated with the fact that one fungus grows on a tree and the other on the ground. While this correlation does exist it does not wholly explain the fundamental difference in behavior. One must take into consideration the difference in the origin of the plant parts, as well as the necessity of a permanent position of the stratum of tubes compared with the change in an agaric, provided the pileus has a general horizontal position, since the gills may descend or ascend from the stipe as the margin of the pileus is elevated and yet spore fall may not be interfered with.

The number of spores produced by a single fruit body was estimated in several species and the enormous number probably far exceeds the estimates and shows how prolific these plants are. An individual of *Agaricus campestris* produces about 2,000,000,000 spores, *Corpinus comatus* about 5,000,000,000, *Polyporus squamosus* about 11,000,000,000, and an individual of *Lycoperdon giganteum,* 40 × 28 cm. (16 × 11 inches) about 7,000,000,000,000. Single fruit bodies of some plants shed spores at the rate of 1,000,000 a minute, and this may be kept up for several days. Notwithstanding this enormous prolificness the waste is enormous because of the small chance of a spore being able to produce a new plant. He estimates that in *Polyporus squamosus,* considering also the perennial character of the mycelium, about one spore in 1,000,000,000,000 has a chance of starting a new successful cycle. The spores are sometimes shed in such vast numbers that they can be seen in clouds floating away from the plant. A species of *Polyporus squamosus* which was growing in a greenhouse shed such vast numbers that, when one entered in the morning and at other times, the air was so filled with spores it appeared as if some one had been smoking there. This continued for thirteen days and the plant continued to shed spores for three weeks. The spore-fall period varies in different individuals of a species. It was determined for several species, and the following examples are given: For *Coprinus plicatilis* a few hours, *Agaricus campestris* two to three days, *Polystictus hirsutus* five days, *Lenzites belutina* ten days, *Polystictus versicolor* sixteen days, *Schizophyllum commune* sixteen days, *Polyporus squamosus* three weeks.

One of the remarkable discoveries is the fact that many xerophytic fungi which have been preserved dry for several months or years may be revived by moistening, when spore fall will be resumed and continue for several days or weeks, even after the plants have been dried and revived several times in succession. Thus *Corticium læve* revived after one year shed spores, *Phlebia pileata* (*Phlebia strigosozonta*) after two years and eight months, *Polystictus versicolor* two years, *P. hirsutus* three years, *Schizophyllum commune* two years, *Trogia crispa* four months, *Lenzites belutina* three years, *Marasmius oreades* six weeks, *Collybia dryophila* one week. Spores of *Daedalea unicolor* and *Schizophyllum commune,* after the fruit bodies had been kept dry for three years, shed spores which were capable of germination as determined by test. This demonstrates that

the shedding is an active process and that the plants were still alive. These two species are the only ones so far tested by the author for germination after such a long period of drying.

The spores are forcibly ejaculated from the sterigmata and fall down from between the gills or from the tubes. Thus spores of *Amanita vaginata* are shot outward with an initial velocity of 400 mm. per second to a distance of about 0.2 mm. The terminal vertical velocity of falling is about 5 mm. per second, while the spore is moist, but it soon becomes about 3 mm. as it dries. For most other species with smaller spores the spores are shot out for 0.5–0.1 mm. and the terminal vertical velocity is about 1–2 mm. per second. The horizontal discharge is so rapid that it can not be seen even with the aid of the microscope.

The terminal vertical velocity is reached in about one four-hundredth of a second. In actual observation and experience, however, the terminal velocity of fall is reached later, owing to the fact that the spores lose water rapidly by evaporation so that the velocity becomes reduced to one half in some and one third in others, the loss of water occuring even in a small compressor cell which contained wet blotting-paper and a drop of water, owing to the relatively high vapor pressure in the small spores whereby moisture passed over by distillation to the large drop of water. The more rapid fall, however, takes place while the spore is passing from between the gills or from the tubes, in consequence of which there is less danger of convection currents carrying them to the wall where they would adhere.

The mechanism of spore discharge in the Hymenomycetes receives special consideration. Several previous investigators have stated that the spores are squirted from the ends of the sterigmata by the bursting of the latter under hydrostatic pressure. Dr. Buller shows very conclusively that in the species studied by him and probably in all the Hymenomycetes this method of spore discharge is impossible. His reasons are as follows: (1) The successive, not simultaneous, discharge of the spores from a basidium. If the spores were squirted off, the basidium would lose its turgor after the discharge of the first one and the others would remain attached, (2) the absence of drops of liquid on the ends of the sterigmata, (3) the apparent closed condition of the sterigmata after discharge, (4) non-collapse of sterigmata and basidia as the spores disappear. While he is not able to state definitely the mechanism of discharge, owing to the very minute size of the point of the sterigma, he arrives at a very reasonable conclusion as to the mechanism. It is that of the existence of a double wall at the junction of the sterigma and the spore so that endosmotic pressure in the basidium and spore causes the rupture of the lateral wall connecting the edges of this double wall. This probably occurs somewhat in the same manner as the sudden breaking of threads of *Spirogyra* in consequence of the high endosmatic pressure of adjacent cells after the middle lamella of the wall has disappeared.

The trajectory described by the spore from the time it leaves the sterigma and follows its vertical path of fall is called the "*sporabola*." It was impossible to observe any portion of the sporabola except the path of vertical fall, since the velocity of discharge is so great, the initial velocity of a spore on leaving the sterigma being 40 cm. per second. The initial velocity is determined from mathematical formula, since the maximal horizontal distance of projection and the terminal vertical velocity of fall are determined by actual observation. These being known by mathematical formula, the sporabola can be plotted. The sporabola is remarkable in that the horizontal part passes with a very sharp curve into the vertical part, and the total declination on the horizontal path is approximately equal to the diameter of the spore. The very rapid slowing down of the horizontal velocity is due, of course, to the enormous friction which the relatively large surface of the minute spore offers to the air, and for the same reason the vertical velocity is very slow. Here is shown a very beautiful instance of correlation to structure and means for distribution. The gills of most agarics

are very close together, from two millimeters to several millimeters apart. If the spores were not shot for some distance from the surface of the gill of the agaric, or tube of the polypore, they would fall upon the surface of the hymenium, and because of their adhesiveness could not escape. If they were shot too far they would strike the hymenium opposite and adhere. In *Agaricus campestris* they are thrust horizontally for about 0.1 mm. and in *Amanitopsis vaginata* about 0.2 mm. They then fall very slowly, and after passing below the gills are easily wafted away by even slight air currents.

The deliquescing Coprini represent another type of fruit body from that of other Hymenomycetes in the very high specialization which has taken place in the adaptations for spore dispersal. *Coprinus comatus,* the shaggy mane mushroom, will illustrate this type. The pileus is large and cylindrical, so that the broad, long gills stand vertically between it and the stem. The gills are very close together. At their edges are numerous projecting large cystidia which are connected with those of adjacent gills. If the basidia and spores matured simultaneously over the entire surface of the gills, or over any considerable portion, as in other agarics, very few of them would ever reach the outer air, since they would lodge on the surface of the gills or upon the numerous large cystidia on the sides of the gills. The basidia and spores are matured, first over a narrow zone occupying the edge at the lower end of the gills. The cystidia on the edges of the gills are dissolved by autodigestion. When these spores are shot off they readily reach the air below by falling. This now sterile part of the gill, by autodigestion, is reduced to a liquid condition. It is blackened probably by an oxydase which unites with certain substances. It is covered by a thin film and by evaporation becomes thinner, so that the spores from a narrow zone next above can readily fall down in the wider spaces thus formed, and so on. At the same time the pileus begins to expand more rapidly at the margin so that by the time the ink drops begin to fall they are out of reach of the falling spores. In contradistinction to the belief held by some that the spores of the Coprini are mixed with the inky fluid and that they are then disseminated by insects,[1] the author believes that under normal conditions very few if any spores are caught in the liquid, and that the spores are anemophilous.

The adjustments of the fruit body of *Coprinus comatus* are as follows: (1) A large number of gills with a very great spore-bearing surface, (2) a thin pileus, thus economizing energy in its development, but incapable of expanding and lifting the weight of the gills, (3) the spacing of the basidia by paraphyses assuring the free projection of the spores, (4) the nearly simultaneous expulsion of the spores from all of the basidia of a narrow zone at the lower edge, (5) the autodigestion of this zone to provide space for the fall of the spores shot from the basidia of an adjacent higher zone, and so on, (6) the gradual expansion of the pileus from its margin inward after autodigestion of the sterile parts of the gills removing the fluid parts from interference with the fall of spores from the successive zones of spore ejection, (7) the continued elongation of the stipe lifting the gills higher so that the spores are more easily caught by air currents.

These adjustments the author believes indicate a higher degree of specialization on the part of the Coprini and that, instead of being a primitive group as suggested by Massee[2] (p. 130), they represent the highest development and specialization of the Agaricini.

In many of the Ascomycetes, as has been long known, the spores are squirted out from the ascus. In *Peziza repanda,* with narrow cylindrical asci, the spores are shot out in a chain along with some of the liquid. The difference in momentum given the successive spores of the chain, together with the spontaneous segmentation of the liquid cylinder in which they are imbedded according to a well-known physical law, separates the spores in the air so that they are wafted away by the

[1] See Fulton, *Ann. Bot.*, III., 215, 1889.

[2] Massee, Geo., "A Revision of the Genus *Coprinus*," *Ann. Bot.*, X., 125–184, pl. 10, 11, 1896.

wind. This represents a type of the Ascomycetes adapted to wind dissemination of the spores. Another type is represented by *Ascobolus immersus* with broad elliptical asci, and large spores which are held together by a broad gelatinous investment so that they remain in a group as a single projectile as they are shot from the ascus to a distance of 20–35 cm. This mass, which is 2,000 times the volume of a basidiospore, is too heavy for wind dispersal. It falls on the surrounding herbage where the spores may be devoured by herbivorous animals and gain dispersal after passing through their digestive tract.

The rate of fall of the spores of the Hymenomycetes was used to test the theory known as Stokes's law relating to the fall of microscopic spheres in air, and it was confirmed to within 46 per cent. For determining the velocity of spore fall under direct observation through the microscope the author employed an ingenious device of an automatic electric recorder, the position of a spore, as it successively passed by spaced horizontal threads in a Ramsden ocular, being registered by a tapping key controlled with the left hand.

The illustrations and press work of this book are good, and besides the very interesting and important discoveries, it is full of stimulating suggestions and possibilities for further investigation.

GEO. F. ATKINSON

Charles Darwin and the Origin of Species. Addresses, etc., in America and England in the year of the two anniversaries. By EDWARD BAGNALL POULTON. New York, Longmans Green and Co.

It is fitting that upon November 14, 1909, the anniversary of the publication of the "Origin of Species," there should be published this memorial volume; fitting also that it should be written by a friend and advocate of Darwin's views in their entirety. Besides the addresses the volume contains some unpublished letters of Darwin and also a preface in which the author takes occasion to express his attitude toward the modern contributions to the study of evolution.

Nothing is more evident than that the younger generation of scientists has departed somewhat from the Darwinism of a generation ago. That fifty years' study of Darwin's great theories, by both friends and enemies, has established the general theories of which he was the most notable advocate upon an unshakable basis is very clear. But equally clear is it that this same half century has raised difficulties as to Darwin's special explanation of the method of evolution; difficulties so great that most of the younger generation of scientists are unable to accept Darwinism in its entirety as an all-sufficient theory. These difficulties have arisen not simply in the minds of Darwin's enemies, but in those of his friends also. That some solution of these difficulties is to be found is the belief of every admirer of Darwin, and moreover every admirer of Darwin must feel that this great master so fully exhausted the study of his great law of natural selection that little can be hoped for further study along the same lines. It is difficult to resist the belief that the removal of the difficulties that have arisen must come along new lines of study and not by the further exploitation of the old ones.

Poulton, however, apparently thinks otherwise and conveys the impression of holding that of the modern theories, that which is new is not true and that which is true is not new. The only real contribution to the discussion since Darwin that Poulton admits is Weismannism, and this he admits, seemingly, simply because it places the great theory of Darwin in a position "far higher than that ever assigned to it by Darwin himself." Of the mutation theory, which most thinkers today recognize as at all events decidedly stimulating, Poulton can only speak with a sneer, both at the theory and at its chief exponent. Some of Darwin's friends have been pleased to feel that Darwin really recognized mutations under the phrase "evolution per saltum" as a part of his theory. But Poulton is at pains to repudiate this idea entirely and to insist that Darwinism is a theory of evolution by minute steps and one of which any conception of mutation forms no part.

One can hardly fail to feel that this refusal to look with charity upon anything new only weakens Darwinism, and can but believe that Darwin himself would have been rather more broad minded. Darwin's position as the most stimulating mind of the nineteenth century stands secure, and he may well be ranked with Newton as one of the two great men that England has thus far produced. In this position he remains no less securely even if we do admit that the details of his great theory do not work out in all respects as he imagined them to do. We admire him not the less, but rather the more, as we learn that the descent theory, which must ever remain associated with Darwin's name, agrees with newly discovered facts as well as with those which Darwin himself knew.

But this volume of essays is written by an advocate, as eminently fitting for an anniversary volume, and it will form a necessary part of the Darwin bookshelf. Any light upon the personal life of the world's great men always has its interest and many a touch upon the life of Darwin given in these papers helps to render the great Englishman a live personality. The life of the man, his long struggle with ill health, his kindness and thoughtfulness for others amid his own suffering, his eagerness to give others even more than their share of credit for his discoveries and his own proverbial modesty, are anew impressed upon us as we read the unpublished letters and the newly given incidents in his life. The oft-quoted loss of appreciation of music and art, which Darwin admitted in his later life, are attributed by Poulton not to the result of scientific study, but to his constant suffering and ill health that made it impossible for him to have any comfort save in the, to him, one all-absorbing occupation of scientific study.

One new contribution of scientific knowledge is found in this volume in an essay upon "Mimicry in the Butterflies of North America," originally read in Baltimore in 1908. Complete mastery of this interesting subject is shown with a wealth of illustrative material. The historical development of mimicry in the western continent is traced in ingenious detail. But Poulton adds nothing, and admits that he can add nothing, to the puzzling question of the *cause* of mimicry. This still remains as great a puzzle as it has ever been, although it is enriched with an abundance of illustrative material by means of which Poulton is enabled to follow the migrations into North America of the successive types of butterflies.

H. W. CONN

SPECIAL ARTICLES

THE EARLIEST DESCRIPTION OF ŒNOTHERA LAMARCKIANA

IN working over the early records of *Œnothera Lamarckiana* I have recently discovered in the Sturtevant collection of the library of the Missouri Botanical Garden, a remarkable manuscript which proves that this plant was originally a species growing wild in Virginia, and that it was the first *Œnothera* introduced into European gardens, about 1614. There has been so much obscurity and doubt regarding the origin and early history of *O. Lamarckiana,* the plant upon which the weight of DeVries's mutation theory largely rests, that a document which proves definitely the facts just stated must be regarded as of prime interest and importance. The frequent claim that *O. Lamarckiana* probably originated in cultivation, either through hybridization or otherwise, is here shown to be without sufficient foundation.

The record in question is a long marginal note in a copy of Bauhin's "Pinax," published at Basil in 1623. The note is written in Latin, in archaic English script, and gives an accurate description of *O. Lamarckiana* as we now know it, though differing somewhat in one or two minor characters. The plants were grown from seeds obtained from Padua in 1619, and the description is evidently written from the living plants. It is remarkable for its accuracy, considering the time it was written, equaling in this respect descriptions which were published much later. The author of the marginal note is apparently one Joannis Snippendale, whose name, in similar handwriting, appears on the title page of the

book. The plant is described under Bauhin's name, *Lysimachia lutea corniculata,* the closely written description covering the whole margin of the page. Numerous marginal notes on other plants, by the same author, are found scattered all through the volume. Among the points mentioned in the description which make it certain that this plant was *O. Lamarckiana* and not *O. biennis* or *O. grandiflora,* the forms with which it has most frequently been confused, may be mentioned the following: (1) the flowers are large, 3 or 4 inches long; (2) the rosette leaves are long, pointed and obscurely sinuate; (3) there is present on the branches a type of hair arising from red papillæ;[1] (4) the buds are quadrangular. The first character distinguishes the plant from *O. biennis,* while either of the characters (2) or (4) make it certain that the plant is not *O. grandiflora.*

The differences from the *O. Lamarckiana* of our present cultures are that the rosette leaves seem to be narrower and paler green, and there are secondary branches. The last point is sometimes true of our present *O. Lamarckiana.* The characteristic crinkling of the leaves is not mentioned in this account; but it is definitely described in an independent account of an *Œnothera* from Virginia, published by another author in 1651.

This marginal note is the earliest description of an *Œnothera* now known to exist. I have not yet been able to learn anything regarding its worthy author, but he may have been connected with a garden in England, and he was certainly a close observer. The record is as complete and accurate as could be desired, to prove to one familiar with the characters of these forms the identity of the plants in question. It is safe to say that there are few American plants of which there is such an early accurate record as this.

DeVries called attention, in 1905, to records which showed that the *O. Lamarckiana* at present found in European gardens, and from which the plants of his cultures also originated, was introduced into Europe from Texas in 1860. The manuscript here referred to shows that the Virginia plant was very similar to, and possibly identical with, the form from Texas.

Other records, which I shall not refer to here, show that *O. Lamarckiana,* which must have been derived from the Virginia plants, had escaped and was growing wild in England as early as 1805, and probably much earlier. Cultures of this English form by MacDougal, and more recently by myself, have shown it to be almost or quite identical with the *O. Lamarckiana* of DeVries's cultures.

Owing to the authority of Linnæus, later writers failed to distinguish between large-flowered and small-flowered forms, both going under the name of *O. biennis.* Not until after *O. grandiflora* was introduced into Kew from Alabama in 1778, was *O. Lamarckiana* segregated as a separate form; first described by Poiret under the name *O. grandiflora,* for which Seringe afterwards substituted the name *O. Lamarckiana.* An unpublished description of *O. grandiflora* Ait., by L'Heritier, dated about 1788, is far more complete than the brief characterizations of Aiton and Willdenow, and is important in proving that the *O. grandiflora,* as we now know it from Alabama, was the form described. This manuscript I have also seen.

Photographs and transcriptions of these manuscripts, together with other important historical data regarding these forms, whose identity has been subject to question, will be published at another time. Of these records, the first mentioned is evidently of extreme importance, showing as it does that a form at least closely similar to our present *O. Lamarckiana* was the first *Œnothera* introduced from Virginia into European gardens, and hence that it did not originate in cultivation.

R. R. Gates

Missouri Botanical Garden

[1] This character is also present in some forms of *O. grandiflora.*

Ophidian Notes at Thompson's Mills, North Georgia

The scarlet snake (*Cemophora coccinea* Blumenbach) appears to be more or less widely

distributed throughout the higher piedmont region of Georgia. During the spring of 1909, the writer captured two individuals at Thompson's Mills, North Georgia. One, a very small specimen, was found beneath some rocks in a dry, upland thicket, beneath which was a vigorous growth of *Opuntia opuntia*. The second specimen, which was of rather large size for the species, was dug from soft, rich soil in low ground bordering a small creek. The scarlet snake is very beautifully patterned above with scarlet, orange and black. It is a rather sluggish creature and is perfectly harmless, usually making little effort to escape when handled. Owing to its habit of keeping concealed beneath rocks, decayed logs or soil, this little snake is not frequently seen. Although the scarlet snake can not be considered a common species in this region, yet many of the farmers here claim they have met with them, usually during spring plowing. The scarlet snake probably occurs at higher altitudes in Georgia, though less frequently. It has been taken at Gainesville, Georgia.

Until the summer of 1893, when a specimen of this snake was taken in the District of Columbia, its range was recorded only from South Carolina, throughout the Gulf States to the Mississippi, mainly in the coastal plain area. Although it appears most abundant in the low, sandy coastal areas of the southeastern states, and has been considered typically an austroriparian form, it is without doubt also well represented in Georgia throughout the Carolinian area, and the limits of its range come very close to the mountains.

The copperhead (*Ancistrodon contortrix*) Linn. is occasionally taken in the Thompson's Mills region. This reptile is widely distributed throughout the east from New England to Florida and beyond the Appalachians to Illinois. In the Thompson's Mills region the copperhead is confined generally to more or less wooded, dry upland situations. It especially prefers dry, rocky hillsides. Its rich brown mottlings of various shades harmonize it well with the soil and dead leaves of thickets and open rocky woods, which it frequents. The food of the copperhead consists of various small creatures as frogs, mice, etc., and very probably caterpillars and insects also. At Thompson's Mills, in October, 1909, the writer saw a pair of large copperheads killed in a shallow ditch on a dry, wooded hillside. Both were lying stretched out together in the sunshine when killed. It was discovered that one of these had in its mouth a very large, hairy caterpillar frequently seen in oak woods.

The copperhead is one of our dangerously poisonous snakes, but will usually try to escape quietly if given a chance. It should be particularly looked for around rocky cliffs in dry woods, for this is its favorite habitat. The writer well remembers meeting a copperhead in this situation while collecting ferns. He had jumped down into a shallow, rock-enclosed hollow filled with leaves. There was a sudden commotion beneath his feet of some creature trying vigorously to escape, which at first thought he concluded must be a rabbit. On glancing down, it was something of a surprise to see a huge copperhead securely pinned down by his weight. It took but an instant to leap completely clear of snake and hollow, and the reptile slowly made its escape among the rocks.

H. A. ALLARD

BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.,
December, 1909

ON CHANGES OF ATMOSPHERIC PRESSURE IN NORTH AMERICA

IN order to arrive at a clear understanding of the complex phenomena of periodic or non-periodic climatical changes—and the effect they have on the yield of crops—I found it necessary to approach these problems in a very systematic way.

It seemed to me that two kinds of investigations had to be made simultaneously.

Firstly, the research of the meteorological causes having affected the crops, during different years in different countries. In the case of the United States it would be easy to draw conclusions from the great amount of information collected and published by the de-

partment of agriculture, if this information were only coordinated according to the needs of such a research.

Secondly, to find and then to solve, one by one, the problems of dynamical climatology.

Working along this line and leaving aside, for the present, the continuation of my study on modes of formation and progressive displacements of the thermopleions and antipleions,[1] this study being extremely difficult, I found simpler and more fundamental phenomena by drawing maps of the annual departures of atmospheric pressure.

These maps led me indeed to most unexpected conclusions.

Considering the data of the tables of "barometric pressure" of Sir Norman Lockyer, and utilizing the departures given in Bigelow's report on atmospheric pressure, as well as those published in the annual summaries of the *Monthly Weather Review*, I drew curves showing the geographical distribution of equal departures.

I found that, with few exceptions, the areas of positive and negative departures displace themselves from east to west, from the Atlantic across America toward the Pacific. In reality, however, the movements of the areas of hypo- and hyper-pressure are very complicated, there being generally two distinct directions of propagation simultaneously apparent. Some maps show clearly the existence of intercrossing waves coming from beyond the northeast and southeast of the United States.

These waves are extraordinary because of their slow progress. To verify the fact that waves of hyper- and hypo-pressure of the map of a given year are really those of the preceding year displaced westward, I have calculated consecutive annual means.

The diagrams of these figures—for stations situated along the presumed path of a center of too low or too high annual pressure—show that it is really with a wave movement, of a particular kind, that we have to deal.

I shall not dwell on the details, this being but a preliminary notice of a paper which will be published in the *Bulletin of the American Geographical Society*. I must state, however, that my method of utilizing consecutive means, which makes it possible to draw yearly maps from month to month, will enable me to foresee the changes which will occur.

To know how far this method may be applied to forecast seasonal distribution of pressure, I must first investigate the yearly variations of pressure, and calculate the consecutive means of many series of observations, to find out if there is not a periodicity in the long-range atmospheric waves.

From the discussion of annual maps it appears most probable that the amplitudes of those waves increase and decrease in harmony with the sun-cycle of about eleven years.

Henryk Arctowski

New York

[1] Arctowski, "L'enchaînement des variations climatiques," Bruxelles, 1909.

COLLEGIATE INSTRUCTION

The Committee on College Instruction of Section L, of the American Association, recently ordered the publication, if practicable, of certain samples of the facts obtained in a study of (1) the size of classes (a "class" being defined as a group of students dependent upon one teacher for instruction in a course) and of (2) the actual work done by individual students in fulfilment of the requirements for the A.B. degree. By the courtesy of the editor of Science, these facts are now printed.

Size of Classes

In almost all colleges that report the conditions of instruction in this particular, there is an enormous variability in the size of the groups taught by a single teacher in undergraduate courses. Within the same institution the number will commonly range from three or even fewer to a number equal to a fifth of the entire student body. The facts in this regard have been reported, though not every year, and not without many ambiguities, by Boston University, Bowdoin, Brown, Bryn Mawr, University of California, Harvard, Johns Hopkins, Stanford, Oberlin, Radcliffe, University of Texas, Tufts, Western Reserve,

Williams and probably by a number of other institutions.

Because of the ambiguities of the reports in respect to the exact number of sections, the exact share taken by each officer of instruction engaged in a course, the conduct of laboratory and composition courses and the like, it was not possible, without asking much assistance from many colleges, to determine the exact frequencies of classes of all sizes. But the figures of Table I., which are approximately correct, will give a sufficient idea of this enormous variability. It is even greater in large colleges like the University of California, Harvard or Stanford.

TABLE I

Relative frequencies of different sizes of class in American colleges, a class being defined as a group taught by only one person. In per cents.

Size of Class	Boston University	Brown	Wesleyan	Bowdoin	Beloit	Knox	Wabash
1–9	16.5	38.9	36.6	22.8	42.5	27.5	82.5
10–19	13.2	26.2	22.8	22.8	25.2	25.0	14.2
20–29	14.8	17.6	19.5	22.8	18.1	12.5	26.4
30–39	11.5	9.5	8.1	9.8	4.7	12.5	14.2
40–49	3.8	2.1	2.4	9.0	2.4	12.5	2.0
50–59	3.8	1.7	4.9	6.5	1.6		
60–69	3.8	2.1	.8	4.1	1.6	3.8	2.0
70–79	4.9	.5		.8	1.6		
80–89	4.9	.5	.8[2]	.8			
90–99	4.9	.2				1.3	
100–109	3.8					3.8	2.0
110–119	3.8	.3		.8[3]	.8		
120–129	2.7	.5					
130–139							
140–149	.5[1]						

There is also great variability amongst institutions with respect to the provision for teaching the same subject-matter. The first- and second-year courses in French and German, for example, are, in one college, given to sections of 13 students and, in another, to sections of 41 students. The first course in philosophy or in psychology is in some institutions divided into sections of 40 students, while in others the entire class of two hundred or more is left to one teacher, with presumably some assistance in the examination of written work. Similar differences exist in the case of all departments enrolling many students. In some institutions the enrollment is less than ten in only a sixth of the classes, while some devote nearly half of the teaching hours of their staff to the conduct of classes of less than ten students.

It is not the purpose of this report to discuss this condition of college teaching, but it is the committee's opinion that the following questions are worthy of discussion in college faculties and by those responsible for the financial provision for college instruction.

1. Is not the number of students taught at one time by a single individual in many college courses so great as to reduce that individual's knowledge of the attitude, preparation, difficulties, errors and achievements of his students to almost zero?

2. Is not the number of students taught at one time by a single individual in many college courses so small as to involve an enormous waste of the instructor's time and an improper distribution of the appropriations for teaching?

3. Other things being equal, should not the teaching of more than 40 college students at one time by one person be avoided? Should not any department have reasons of weight for any such case?

4. Other things being equal, should not the use of a quarter or more of a professor's teaching hours for a year for the instruction of fewer than ten students in one undergraduate course counting one twentieth or less of the degree's total requirement be avoided? Should not any department have reasons of weight for any such case?

5. Should not the traditional method of having the ratio which the number of class meetings is to the number of "points" credit the same, regardless of whether the class enrollment is 1, 5, 10, 20 or 100, be abandoned in many of the undergraduate courses enrolling less than 10 students?

[1] Also 1.1 at 200 and .5 at 220.

[2] A course in chemistry. Help in the laboratory is probably given by others than the one instructor.

[3] A course in hygiene.

6. When, in a college course given annually, the number of students is less than 6, should not the course be offered only once in two years, except for reasons of weight?

The Actual Curricula of Individual Students

The committee gathered 500 complete records of the courses taken for the bachelor's degree by students representing random samplings of the class of 1909 in the following institutions: Beloit (27), Bowdoin (36), Columbia, (21), Cornell (42), Harvard (50), Knox (13), Lake Forest (10), Marietta (10), Princeton (49), Ripon (10), Stanford (20), Wabash (22), Wellesley (22), Wesleyan (38), Williams (40), Yale (95). These were worked over by the chairman into complete tables like Table II. below, the first line of which reads, "Individual A did 18 per cent. of the total work required for the degree, in courses in ancient languages; 18 per cent. of it in courses in modern foreign languages; 13 per cent. of it in English; 5 per cent. of it in philosophy, 32 per cent. of it in history, economics, etc." These complete tables are too long to be printed, but they can not be summarized in lower terms. I give in Tables III. and IV. samples of the answers which may be got from them, using two arbitrary questions about the extent of specialization and superficiality.

TABLE II

Samples of the work done for the A.B. degree by individual students

		Latin, Greek, Sanskrit	French, German, Spanish, Italian	English	Philosophy, Psychology, Logic, Ethics, Anthropology	History, Economics, Government	Physics, Chemistry	Biological Sciences	Geology, Astronomy, Geography	Mathematics	Music, Fine Arts
Cases from Princeton	A	18	18	13	5	32	5		2	6	
	B	30	3	15	7	32	5			6	
	C	32	3	30	5	15	5			6	
	D	18	18	15	5	32	5			6	
	E	18	18	8	5	34	5			6	
	F	20	13	8	5	32	7		2	6	
	G	18	13	25	5	22	5			11	5
	H	18	13	15	5	36	5			6	
	I	23	8	6	5	39	5			6	
	J	20	10	15	12	30	5		2	6	2
Cases from Harvard	A		24	12	3		47	3		6	
	B		18	9		6	41		9	12	
	C	12	6	35	38	6					
	D		68	15		24					
	E	12	12	6	6	12	12			29	6
	F		18	27	15	47	6				6
	G[4]		12	18	15	21	12		3		29
	H	29	12	12	3	35	6		3	9	6
	I[5]		24	15		62		3			
	J[6]		18	18		24	12		18		6

[4] Also 12 architecture and 3 engineering.
[5] Also 6 education.
[6] Also 9 mining and 9 engineering.

TABLE III

	No. of Cases	No. Spending at least 50 Per Cent. of the Total Degree Requirement in:							
		Language and Literature	History, Economics, Etc.	All Natural Science	Engineering	Medicine	Architecture	Law
I. Stanford,	20		1	4	5			(a)
Columbia,	21	5			2	2	1	
Cornell.	42	6	4	7		(a)		(a)
II. Harvard.	50	16	8	3	1			
III. Beloit, Knox, Marietta, Ripon and Wabash.	93	15	3					
IV. Bowdoin,	36	22		2				
Wesleyan,	38	20						
Williams,	40	15						
Wellesley,	22	12		1	See note (b)			
Yale,	95	25	3	1				
Princeton.	49	15						
Total.	506	151	19	18	7 or 7 (a)	2 5	1 1	0 11 by

(a) If the combination of the *hist. ec. gov.* group with law is counted as one group, and if the combination of science and medicine is counted as one group, we have added 11 cases (8 at Stanford, 3 at Cornell) of the former sort and 5 cases (at Cornell) of the latter sort of specialization.

(b) One case for music and art.

Of these cases of apparent scattering 34 are individuals each giving over three tenths of the total degree-requirement to history, economics, etc., and many of the others represent conceivably

TABLE IV

	Number of Cases	Number not Devoting 20 Per Cent. of the Total Degree Requirements to any one of the Following: (1) Ancient Languages. (2) Modern Foreign Languages. (3) English. (4) Philosophy, etc. (5) History. (6) Economics. (7) Government and Public Law. (8) Physics and Chemistry. (9) Biological Science (10) Other Natural Sciences. (11) Mathematics. (12) Art and Music. (13) Education. (14) Law. (15) Medicine. (16) Engineering. (17) Architecture	Per Cent.
I. Stanford	20	0	0
Columbia	21	0	0
Cornell	42	0	0
II. Harvard	50	6	12
III. Beloit, Knox Marietta Ripon and Wabash	93	16	17
IV. Bowdoin	36	0	0
Wesleyan	38	3	8
Williams	40	2	5
Wellesley	22	0	0
Yale	95	7	7½
Princeton	49	23	47
Total.	506	67	13

closely related work. This is the case, for example, with four of the six cases from Harvard.

For the Committee on Collegiate Education of Section L of the American Association.

EDWARD L. THORNDIKE,
Chairman

TEACHERS COLLEGE,
COLUMBIA UNIVERSITY

THE SEXAGESIMAL SYSTEM AND THE DIVISION OF THE CIRCLE

THE division of the hour and the degree into 60 equal parts, called minutes, and the minute into 60 equal parts, called seconds, keeps fresh in our minds the fact that the ancient Babylonians used 60 as a base of numeration. Less than ten years ago all seemed to agree on the probable origin of this system. It was assumed that the ancient Babylonians supposed that there were only 360 days in a year and hence divided the circle so that one day corresponded to each division. In support of this hypothesis it was pointed out that the ancient Chinese divided the circle into 365¼ parts in their *Tcheou pei,* and that this work could not have been written before 213 B.C.; but at this early date the Chinese were already acquainted with the year of 365¼ days. From the assumption that the circle was divided into 360 equal parts before the origin of the sexagesimal system, and the fact that the radius of a circle can be applied exactly six times as a chord of the circumference, it was easy to account for the base 60.

In recent years this question has received considerable attention and many arguments have been advanced against the given hypothesis as regards the division of the circle. These arguments appear convincing, but it is not so easy to replace the old theory by one which is free from objections. In the third edition of his classic "Vorlesungen über Geschichte der Mathematik" (1907, volume I., page 37) Moritz Cantor accepts the hypothesis that the base 60 was selected as a consequence of the mingling in the Babylonian country of two ancient civilizations, one employing 10 and the other 6 as a base of numeration. In view of the difficulties which this hypothesis entails efforts have been made to find a more plausible one.

Professor Edmund H. Hoppe, Hamburg, Germany, has recently advanced such a hypothesis[1] and has given a large number of historical facts tending to its support. He assumes that the normal angle among the ancient Babylonians was an angle of an equilateral triangle and that it was observed at an early date that six such angles cover the entire area around a point. Hence the number 6 assumed great importance, being regarded to stand for completeness. The base 60 could then have easily resulted from a division of the normal angle into ten equal parts. After this base was established, alongside the much older base 10, the normal angle itself was divided into 60 equal parts and this led to the division of the circle into 360 equal parts.

Whether this hypothesis will be generally accepted remains to be seen. The fact that the

[1] *Archiv der Mathematik und Physik,* Vol. 15 (1910), p. 304.

ancient Babylonian wheel had six spokes while the ancient wheels in Egypt and Greece had only four tends to support the hypothesis that among the former an angle of 60° was regarded as normal while the right angle was regarded as normal among the latter. At any rate, the hypothesis advanced by Professor Hoppe tends to throw additional light on a question which relates to our daily experiences, but had not received a satisfactory answer.

G. A. Miller

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NOTES ON ENTOMOLOGY

The first volume of Mr. Kirkaldy's long-expected catalogue of the Hemiptera Heteroptera of the world has been issued, and is truly a great work. Indeed it is, if possible, too extensive and elaborate for ready reference. This volume[1] treats of the families known to us as Pentatomidæ, Scutelleridæ and Cydnidæ. The general plan is similar to that of the Lethierry and Severin Catalogue: the species of each genus are numbered, the localities at the right side of the page, and each reference includes the generic name used by each writer. Wherever known the food plants are given. In the introduction he has a classification of the order, and an exposition of the rules of nomenclature followed by him, which differ in several respects from those commonly adopted by entomologists.

The era of discovery of strange insects is not yet passed. Dr. Karl Jordan has described a new and truly remarkable genus of insects which was found in a sack on the wings of a Malayan bat.[2] He considers that it belongs to the Forficulidæ, but its resemblance to the common earwigs is extremely slight. It is a very flat insect, with a pair of small, curved, oval cerci; the pro- and mesothorax have a median suture; the head looks like that of a perlid larva, with a suture from eye to eye, the basal joint of the antennæ is very large and long. Dr. Jordan calls it *Arixenia esau*. He considers that it shows some relation to *Hemimerus*, and that it may possibly form a new suborder of Orthoptera. It might be useful to compare the insect with some of the Mallophaga, as a possible connecting link between them and some of the neuropteroid insects.

Dr. Alex. Schepotieff describes a new genus of primitive insects[3] which he calls *Protapteron indicum;* it comes from the Malabar coast. It is a small, slender form and has some resemblance to *Acerentomon*, but probably more allied to *Campodea*. It has four pairs of rudimentary feet on the basal abdominal segments, each two-jointed. There are no terminal cerci, and the antennæ are slender; there are five widely separated ocelli on each side of the head; each segment has only a dorsal and ventral plate, no other chitinized parts; the tarsi end in a single claw; and there are but two pairs of spiracles.

Dr. Albert Tullgren is the author of a most valuable paper on Swedish Aphidæ.[4] In this first part he treats of the Swedish Pemphiginæ. This subfamily he divides into six groups: Vacunina, Hormaphidina, Mindarina, Pemphigina, Schizoneurina and Anœciina. He gives a full description of each genus and species, and as much of the life history as is now known. He reviews the previous classifications of the subfamily Pemphiginæ, and presents considerable matter on the structure of the group. The numerous figures illustrate the essential structural characters, such as head, antennæ, cornicles and wings.

Dr. A. E. Shipley has given a valuable account of the insects affecting the red grouse in Scotland.[5] These are principally a biting louse, *Goniodes tetraonis*, the bird fly, *Ornithomyia lagopodis* and a dung-fly, *Scatophaga stercoraria*. The author has not found any connection between any of these parasites and

[1] "Catalogue of the Hemiptera Heteroptera," Vol. I., Cimicidæ, pp. 392, Berlin, December, 1909.

[2] *Novitates Zoologicæ*, Vol. 16, pp. 313–326, 1909, 3 plates.

[3] "Studien über niedere Insecten," *Zool. Jahrb., Abt. Syst.*, Vol. 28, pp. 121–135, 1909, 3 pls.

[4] "Aphidologische Studien," *Arkiv f. Zoologi*, Bd. V., No. 14, pp. 190, figs. 92, 1909.

[5] "The Ectoparasites of the Red Grouse (*Lagopus scoticus*)," *Proc. Zool. Soc. London*, 1909, pp. 309–334.

the disease that seriously affects grouse. The figures of the structure of some of these forms are extremely good, and particularly useful are those of the larvæ of the Scatophaga.

M. E. RABAUD has published a brief but interesting article on the habits of certain solitary wasps known as Pompilidæ.[6] He objects to the anthropomorphic interpretations frequently given of the habits of these insects. He notes much variation in the methods of capture and mutilation of prey, as well as in the interest they take in their work. He concludes that the sense which guides the insect in the selection of prey is sight and not smell.

THREE parts of the new "Coleopterorum Catalogus" of Dr. Schenkling have been issued: I., on the family Rhyssodidæ, 11 pp., is by R. Gestro; II., Nilionidæ, Othniidæ, Ægialitidæ, Petriidæ, Lagriidæ, 32 pp., is by F. Borchmann; III., Alleculidæ, 80 pp., is also by F. Borchmann. This name is used in place of the Cistelidæ; the interpretation of *Cistela* familiar to us being erroneous and now called *Gonodera* Muls. The catalogue is on the same plan as the famous catalogue of Gemminger and von Harold, but the derivations of the generic names are omitted.

To the ranks of the peculiar wingless Phoridæ Dr. Trägårdh adds a new genus[7] from South Africa. *Cryptopteromyia jeanssoni* has the wings reduced to mere scales, barely visible, the antennæ have a large bulbous base and a long hairy tip, the legs are long and strong and the body is but weakly chitinized.

THE manual of Indian insects recently published by H. Maxwell-Lefroy and F. M. Howlett[8] will undoubtedly be a most useful work for local students. It is a very bulky volume, and full of interest to those who are unfamiliar with the insects of India. The authors do not treat all Indian insects, those of the hills and the coasts being omitted. There is a long introduction telling of the structure and habits, collections in India, geographical divisions of India, relation of insects to man, etc. Each order is treated from the lowest up to the Rhynchota. Under each are directions for collecting the forms of each family, as well as habits, structure, life-history and number of species in India. As "interludes" are about eighteen chapters on general subjects scattered through the volume; such are: Cosmopolitan insects, deceptive coloring, galls, migration, song of insects, blood-sucking insects, aquatic insects, insects and flowers, etc. A number of figures are copied from other works, but most are original, and the plates are good, although, one fears, sometimes too highly colored. The economic importance of the various species is always considered, and most of the principal injurious forms are figured, often in all their stages.

NATHAN BANKS

[6] "Notes critiques sur les mœurs des Pompiles," *Bull. Sci. France, Belgique*, (7), XLIII., pp. 170–182, 1909.

[7] "Cryptopteromyia, eine neue Phoriden-Gattung mit reduzierten Flugeln aus Natal, nebst Bemerkungen über Thaumatoxena und Termitodeipnus," *Zool. Jahrb., Abt. Syst.*, Vol. 28, pp. 329–346, 1909, 1 pl., 16 figs.

[8] "Indian Insect Life: A Manual of the Insects of the Plains," Agric. Research Institute, Pusa, India, 1909, 786 pp., 535 figs., 83 pls., some colored.

THE BOTANICAL SOCIETY OF AMERICA

THE annual meeting of the Botanical Society of America was held in the Harvard Medical School, Boston, Mass., December 27–31, 1909, under the presidency of Professor Roland Thaxter, over fifty members being in attendance.

The officers for 1910 are:

President—Erwin F. Smith, Bureau of Plant Industry.

Vice-president—Louis R. Jones, University of Wisconsin.

Treasurer—Arthur Hollick, New York Botanical Garden.

Secretary—George T. Moore, Missouri Botanical Garden.

Councilors—William Trelease, Missouri Botanical Garden; F. E. Clements, University of Minnesota; C. L. Sheer, Bureau of Plant Industry.

The following eight botanists were elected associate members of the society: John Hendley Barnhart, New York Botanical Garden; Edward W. Berry, Johns Hopkins University; Mintin Asbury Chrysler, University of Maine; Reginald R. Gates, Missouri Botanical Garden; Otto Emery Jennings, Carnegie Museum; Aven Nelson, University of

Wyoming; Winthrop J. V. Osterhout, Harvard University; Robert Boyd Thompson, University of Toronto; and the following members were elected to full membership: C. E. Allen, University of Wisconsin; A. F. Blakeslee, Storrs Agricultural College; E. J. Durand, Cornell University; J. M. Greenman, Field Museum of Natural History, and Shigeo Yamanouchi, University of Chicago.

Special papers given by invitation of the council were:

"The Nature of Physiological Response," by C. R. Barnes.

"The Place of Plant Responses in the Categories of Sensitive Reactions," by F. C. Newcombe.

"The Distribution of the Vascular Plants of the Gaspé Peninsula, Quebec," by M. L. Fernald.

"A Consideration of the Species Plantarum of Linnæus as a Basis for the Starting Point of the Nomenclature of Cryptogams," by W. G. Farlow.

The subject for the customary symposium was "Nuclear Phenomena of Sexual Reproduction in Thallophytes and Spermatophytes," and was participated in by B. M. Davis, who discussed the subject from the standpoint of the algæ; R. A. Harper, who considered the fungi; C. J. Chamberlain, for gymnosperms, and D. M. Mottier, for angiosperms.

It is expected that all of these papers will be published in *The American Naturalist* and reprints distributed to the members of the society.

Following are abstracts of the papers presented at the two scientific sessions held simultaneously on the afternoon of December 29:

Botanical Collecting in the Yukon Valley: A. S. Hitchcock, U. S. Department of Agriculture. By title.

Some Evaporation Experiments in Relation to Excessive Transpiration: K. M. Wiegand, Wellesley College.

In order to determine, if possible, the comparative value to the plant of hairy and cutinized coverings, a series of evaporation experiments was made in which cotton or wax spread over an evaporating surface of saturated blotting paper were substituted for a hairy leaf or a cutinized leaf, respectively. Comparative readings of the loss of water from the variously treated blotting papers in still air and in wind were made, with the following results: the evaporation was retarded much more by the wax than by the hair; the efficiency of the hair, however, was much greater in wind than in the quiet, and even very thin hairy coverings produced a noticeable retarding effect in wind. In sunshine the retarding effect was also marked. Plants might therefore be supposed to make use of waxy coverings when transpiration is to be retarded at all times, and hairy coverings when it is to be retarded only if exposed to strong dry winds and sunshine.

The Responses of the Guayule, Parthenium argentatum Gray *to Irrigation:* Francis E. Lloyd, Alabama Polytechnic Institute.

A brief summary of the more important results of a study of the guayule, *Parthenium argentatum* Gray, under irrigation at Cedros, Mexico, for a period of two years, touching (1) the rate of growth, (2) the anatomical changes which ensue and (3) the rate and amount of rubber secretion together with a discussion of centers of secretion.

Guayule under irrigation makes an annual gr wth up to 25–30 cm. stem length, which appears to be approximately the maximum rhythmic response. Field plants in the same region make an average growth of 3 cm. Guayule responds readily, therefore, to irrigation, making plants of two to three pounds in weight from closely pollarded stocks.

At the close of two seasons' growth in August, 1908, irrigated plants showed only minute quantities of rubber. The same plants in the following April showed a large though not a maximum amount. Still more was found to occur in plants which had received less water of irrigation, this in growths of 1908 and 1909, in October, 1909. The conclusion is arrived at that, though the rate of secretion is slower in more rapidly grown plants, it may, after drought, approach fairly closely, if not entirely, to the maximum. The behavior under irrigation may be regarded as the behavior in feral plants with an exaggerated time element. In view of the total amount of growth, however, the conclusion that a total amount of secretion in an irrigated plant is greater in the long run than in a field plant is justified.

It is further shown that marked anatomical changes result from irrigation, chiefly affecting the volume of the cortex which is reduced under irrigation. The volume of the medullary rays is also much less, and sclerosis overtakes the medullary rays cells and sometimes the pith cells. The effect upon the amount of rubber is apparent in view of its distribution in these tissues, and not in the xylem and phloem (the parenchyma of these excepted).

The rubber is secreted from the secreting cells

of the resin canals as centers. The resin is not secreted within these cells and this supports Tschirch's view of resin secretion.

The paper was illustrated by means of photomicrographs and diagrams.

The Origin of Natural Parks: FREDERIC E. CLEMENTS, University of Minnesota.

During the past summer a special study was made of the natural openings typical of many of the mountain forests of Colorado. These so-called parks range in size from hundreds of square miles, as in South Park and San Luis Park, to a few acres. They occur in practically every one of the forest formations, and are themselves swamp, grassland or chaparral of varying structure. This was clearly found to be due to the fact that parks are only stages in successions, the ultimate stage of which is the surrounding forest in the great majority of cases. Fire was found to be the most frequent cause of the successions that produce parks, while some the largest and most striking are due to the filling of lakes with silt and plant remains. Parks also follow the filling up of canyons by sedimentation, while temperature and migration are more or less frequent causes of parks.

The Intensity of Alpine Light: FREDERIC E. CLEMENTS and FREDERIC K. BUTTERS, University of Minnesota.

Readings were made during the past summer in the Selkirk Mountains, on Mt. Rainier, and in the Rocky Mountains of Colorado in accordance with the same general plan. These were designed to test the series of results obtained in Colorado for a number of years, and to determine whether mountain regions with higher humidity would reveal greater absorption. The readings made in the two regions are in close, if not complete, agreement, and confirm the original conclusions that alpine light is little if at all stronger than the light at lower altitudes, and that it can not be an efficient cause of alpine dwarfing.

The Morphology of a Remarkable New Gymnospermous Genus: E. C. JEFFREY, Harvard University.

The genus is characterized by the possession of the wood structure found in the araucarian genera *Araucaria* and *Agathis*. It differs, however, strikingly from these genera in the possession of short shoots, which resemble rather those of *Ginkgo* than those of *Pinus*. The short shoot, or brachyblasts, persisted through many years and their bases, embedded in the secondary wood of the main axis, in spite of their obvious perennial character, present only a single zone of annual growth. The short shoots were axillary to deciduous leaves, the traces of which, unlike those of *Agathis*, *Araucaria* and allied extinct genera, do not persist in the secondary wood. The genus is named *Woodworthia*. It constitutes one more link between the abietineous and araucarian conifers, which it is now apparent are connected by annectent transitional forms.

Color Inheritance in Lychnis dioica: GEORGE HARRISON SHULL, Station for Experimental Evolution, Carnegie Institution.

Several years ago I showed that the purple color of *Lychnis dioica* is a typical Mendelian dominant character. It has since been found to present several distinct grades of color, not noted at first, but now shown to be due to distinct Mendelian unit-characters. Most noteworthy of these is a light bluish-purple tint due to basic anthocyan, which is *hypostatic* to the corresponding acid or reddish-purple anthocyan. Blue anthocyan has generally been found to be *epistatic* to red in other cases.

Notes on the Behavior of Certain Hybrids of Œnothera in the First Generation: BRADLEY MOORE DAVIS, Cambridge, Mass.

A demonstration and discussion of material illustrating the characteristics in the first generation of the following hybrids of *Œnothera:* (1) *gigas* × *Lamarckiana*, (2) *muricata* × *gigas*, (3) *muricata* × *grandiflora*, (4) *grandiflora* × *biennis*, (5) *biennis* × *grandiflora*.

The characters of the parents, as presented in each cross, were so blended that as regards the measurements of parts, habit, texture of foliage, etc., the average for each set of hybrids would probably present a fair mean between the parents concerned. There was, however, a wide range of variation in the resemblance of the hybrids to one or the other of the parents.

No character of either parent was discovered which appeared as dominant in these hybrids of the F_1 generation, after the manner which has been described for certain forms (*e. g.*, *Pisum*) that illustrate most conspicuously Mendelian dominance in the first generation.

Some of the hybrids of each cross presented a greater resemblance to one parent and some to the other, and the forms could therefore be arranged in two groups (twin hybrids) in one of which the maternal characters were most evident and in the other the paternal. There was no clear evidence

that the hybrids of these cultures carried in marked preponderance the paternal characters (patroclinous), or, on the other hand, that maternal characters were more prominent. The range of variation among the hybrids was too great to permit of such conclusions.

The Effect of Some Toxic Solutions on Mitosis in Vicia faba: W. W. Stockberger, Bureau of Plant Industry, U. S. Department of Agriculture.

Root-tips of *Vicia faba* were exposed for varying lengths of time to the action of very dilute and to more concentrated solutions of copper sulphate, phenol and strychnine. As a result the achromatic figure was frequently enlarged and the spindle seemed to increase in size. Later the spindle fibers were more seriously affected, becoming disorganized, while numerous vacuoles formed in the cytoplasm. Mitosis was interrupted, but without deformation of the chromatic figure. Formation of the cell plate was often prevented, following which, however, complete reconstitution of the nuclei was not observed. Neither the binucleate cells nor the nuclear fusions of some authors occurred in the material studied. No amitosis was observed and there was no evidence that it is produced by these solutions. The interpretation as departures from the normal due to the toxic solution of the numerous aberrant forms which occurred in the toxicated material was negatived by the occurrence of similar forms in the controls. Material grown in distilled water was affected in much the same manner as that in the toxic solutions. When toxic salts were used in great dilutions it became very difficult to distinguish between their effect and the physical action of the solution in which they were dissolved.

Nuclear Organization in the Conidia of Sphærotheca: R. H. Harper, University of Wisconsin.

Polarized nuclei with a central body in permanent connection with the nuclear chromatin and similar in all respects to those described for the ascocarp and mycelium of *Phyllactinia* are found also in all stages of the development of the conidia of the *Sphærotheca* on *Bidens*.

The resting stages are of especial importance, as it is at this time that the connection of centrosomes and chromatin is of especial significance as giving evidence of the permanence of the chromosomes as definitely organized bodies.

The center in these conidial nuclei is disk-shaped and lies on the outside of the nuclear membrane. Cases in which the center is pulled into the cavity of the nucleus are found, but are plainly artefacts due to fixation, as are probably also the similar cases figured by Maire and Guilliermond. The chromatin in the resting condition may appear almost homogeneous and evenly distributed in the nuclear cavities, but even here a few strands show the special connection of the mass with the central body.

In the prophases the granular material becomes gradually aggregated in strands which show a definite orientation toward the central body. The gradual differentiation of a spirem can be traced in all its stages and the heavy strands finally formed are always attached at one end to the center. Throughout the resting stage and prophases organic connection is maintained between the central body and chromatin and thus a mechanism is provided for the maintenance of the individuality of the chromosomes through the processes of splitting in nuclear division and of fusion in pairs side by side in fertilization. The spindle formation follows the usual type which I have described for the nuclei of the ascus.

Nuclear Phenomena in Lachnea scutellata: William H. Brown, Johns Hopkins University. By invitation.

The asci of *Lachnea scutellata* arise from a one-celled ascogonium at the base of the fruit-body. No antheridium has been observed and no fusion or pairing of nuclei in the ascogonium or young ascogenous hyphæ. The nuclei of the vegetative hyphæ, ascogonium and ascogenous hyphæ show five chromosomes. During prophase these chromosomes may be close together and resemble a second nucleolus. In reorganizing, the daughter-nuclei are often so close together as to appear to be fusing. These two phenomena may have been mistaken by some for fusing nuclei.

The usual hooks are formed at the ends of the ascogenous hyphæ. The two nuclei of the penultimate cell may fuse and give rise to the nucleus of an ascus, or they may not, in which case a second hook is formed. An opening is formed between the ultimate and penultimate cells and the nucleus of the penultimate migrates into the ultimate, which may then form a second ascus or another hook. This process may be repeated many times.

The first division of the nucleus of the ascus is the reducing division and shows the usual heterotypic prophases. It is the only division that shows the diploid number of chromosomes.

The spore wall is laid down near the outer

limits of the recurved spindle fibers, but it is not formed out of them.

Two Trunk Diseases of the Willow Oak (Quercus phellos): HERMANN VON SCHRENK, St. Louis, Mo.

The willow oak is attacked by two polyporoid fungi which destroy the heart wood. No such diseases have hitherto been described, and the discovery at this time was due to the unusual hurricane which destroyed vast numbers of trees in the southern states during the past fall.

A description of the cause of the disease, the manner in which the trees are attacked and destroyed and the distribution form the chief topics of the paper.

A Trunk Disease of the Osage Orange (Toxylon pomiferum): HERMANN VON SCHRENK, St. Louis, Mo.

The osage orange has hitherto been considered as practically immune from fungus diseases. The wood of this tree is very indestructible when used for structural purposes, and so far as known, no fungus ever attacks the heart wood. The present paper describes the finding of fungus disease of the heart wood, which occurs in living trees. This disease is of particular interest in view of the geologic age of the genus, and furthermore in view of the fact that this is the first case of a trunk disease of this species.

Studies on the Toxicology of Diplodia zeæ: HOWARD S. REED, Agricultural Experiment Station, Blackburg, Virginia.

A brief examination of the literature dealing with the etiology of pellagra shows great diversity of opinion as to the identity of the fungi held responsible for the deleterious property of the affected maize. In this connection attention is called to the recent spread in this country of *Diplodia zeæ*. This fungus became conspicuous as the cause of wide-spread injury to maize almost simultaneously with the appearance of pellagra. It is also present in European countries where pellagra is found. Recent studies have shown that the fungus lives parasitically upon the growing maize as well as saprophytically upon the mature grain.

The author has in progress chemical and physiological experiments upon the properties of maize infected with *Diplodia*. The chemical substances isolated to date have similarity to those isolated by Lombroso. Physiological experiments have shown that the infected maize is toxic to small animals.

Some Notes on Sclerotinia fructigena: JAMES B. POLLOCK, University of Michigan.

Aderhold suggested in 1905 that the species of *Sclerotinia* commonly attacking stone fruits in the United States was *S. cinerea* and not *S. fructigena*, as had been assumed. He based his opinion on several facts: the color of the tufts of macronidia on the attacked fruits, the size of the conidia, the occurrence in Europe of *S. cinerea* chiefly on stone fruits and of *S. fructigena* on pome fruits, and lastly on the size of asci and ascospores which Norton described in 1902.

Studies were made on material collected at Ann Arbor and Lansing, Michigan, and this was compared with the reports of various workers in Europe and the United States. The conclusions reached are:

Norton's measurements for asci and ascospores are probably incorrect. The apothecia found in Michigan as well as in other parts of the United States agree very closely with those of *Sclerotinia fructigena* as found in Europe. There is a wide range in the size of the macroconidia, especially on artificial media, and as found in nature they are generally smaller in the United States than in Europe.

In the United States the species occurs more commonly on stone fruits, and in Europe more commonly on pome fruits.

Sclerotinia fructicola (Winter) Rehm is in all probability the same species as *Sclerotinia fructigena* (Pers.) Norton.

The Present Status of the Cytology of the Rusts: E. W. OLIVE, South Dakota State College of Agriculture and Mechanic Arts.

Only fourteen species of rusts have contributed so far toward a solution of the problem as to the sexual cell fusions in this group of fungi. Of this number, nine were æcial forms, five telial. Blackman himself leaves his four telial species in a doubtful condition; and the writer's work on the development of the æcidium cup forms casts doubt on the interpretation of both Christman and Blackman as to the four cup forms which they studied; thus leaving only six species in a presumably stable condition as to the method of sexual union. Of these six species, three—*Gymnoconia interstitialis*, *Phragmidium speciosum* and *Phragmidium violaceum*, belong to the diffuse cæoma type of æcidium; two—*Phragmidium potentillæ-canadensis* and *Triphragmium ulmariæ*, to the primary uredo type, and one—*Puccinia transformans*, to the micro-puccinia type.

To this list the writer is now able to add three of the cup-æcidium type of rusts as showing sexual fusions. Further, a large proportion of the fifty species of æcidium cups under investigation have been found to show a multinucleated stage in their development; this stage following, in the three species above mentioned, the sexual fusions. A contribution has been also made in this investigation toward the solution of the problem as to the origin and function of the peridium, it being found to arise in the manner described by Rosen and Richards. Some observations seem to show, moreover, that the peridial cells exert a sort of digestive function, in addition to acting as a protection to the expanding æcidial mass.

Cultures of Uredineæ in 1909: J. C. Arthur, Purdue University.

The paper covers a report in detail of the work in growing plant rusts during the year 1909, this being the eleventh year that the work has been carried on. It is almost entirely devoted to the heteræcious species of grass, sedge and cedar forms. One new species of the last has been separated, having æcia on *Amelanchier* leaves of the type of *Ræstelia cornuta* and telia on the branches of red cedar. Only one new combination was worked out among the grass rusts, and none among the sedge rusts, but much additional information is reported on species previously cultivated.

George T. Moore,
Secretary

SOCIETIES AND ACADEMIES

THE PHILOSOPHICAL SOCIETY OF WASHINGTON

The 676th meeting was held on February 12, 1910, President Woodward in the chair. Two papers were read.

The Solar Constant of Radiation: C. G. Abbot, of the Astrophysical Observatory of the Smithsonian Institution.

The speaker stated that when in 1903 determinations of the solar constant of radiation were begun by the Smithsonian Astrophysical Observatory, values ranging from Pouillet's 1.76 to Angström's (withdrawn) value of 4.1 calories were quoted in the best text-books, generally with a preference for Langley's value 3.0 calories. The discrepancy existed (1) because no international standard scale of pyrheliometry had been established, so that measurements of different observers might differ by ten or even twenty per cent., according to what pyrheliometer they employed; (2) because, since no spectrum energy measurements had been made except by Langley (and his wrongly reduced), the observations made were incapable of yielding the correction for loss in air, and hence recourse was had to purely empirical and untrustworthy formulæ of extrapolation.

At Washington, Mt. Wilson and Mt. Whitney (sea-level, one mile and three miles elevation) complete spectro-bolometric and pyrheliometric measurements have been made on several hundred different days from 1903 to 1909. Simultaneous determinations at Washington and Mt. Wilson in 1905 and 1906 agreed within the probable error of the Washington observations. Simultaneous observations at Mt. Wilson and Mt. Whitney in 1909 agreed within 0.5 per cent. Hence it is believed that the formula of Bouger for the atmospheric extinction of monochromatic rays (such as the bolometer observes) is not only theoretically well grounded, but experimentally verified, for otherwise the solar constant values obtained by its aid from such different atmospheric levels could hardly agree.

Three different copies of Abbot's water-flow standard pyrheliometer have been tried on Mt. Wilson with closely agreeing results. In this instrument the measurements are checked by observing known quantities of heat electrically introduced. The scale of the instrument appears to be about three per cent. above that of the new Angström pyrheliometers, but careful redeterminations of the constants of the Abbot pyrheliometers are now being made by Mr. Aldrich, and these may alter the scale by as much as one per cent. When verified, four silver disk secondary pyrheliometers of the Smithsonian Institution will be calibrated to this scale and sent abroad to promote a uniform international system of pyrheliometry.

Provisionally the mean value of the solar constant may be given as 1.92 calories per square centimeter per minute.

Mr. Abbot also spoke briefly of the apparent variations of the solar constant of radiation.

The Nitrogen Thermometer from Zinc to Palladium: A. L. Day and R. B. Sosman, of the Geophysical Laboratory of the Carnegie Institution of Washington. Presented by R. B. Sosman.

The preliminary work of Day and Clement at the geophysical laboratory developed the apparatus for accurate measurement of temperatures with the nitrogen thermometer. It consisted of

the following essential parts: (1) a gas-tight platin-iridium bulb of constant volume; (2) a platinum resistance furnace, arranged to give a uniform temperature over the bulb; (3) a gas-tight furnace jacket, water cooled, arranged to provide the same pressure outside as inside; (4) an open mercury manometer, with the minimum possible unheated volume between bulb and manometer.

In the present work, an alloy of 80 Pt, 20 Rh, has been substituted for the Pt-Ir in order to avoid the error due to contamination of the thermoelements by Ir.

All of the errors and corrections have been examined and their amount, as far as possible, experimentally determined. The greatest error to which the present gas thermometer is subject is the lack of uniformity in temperature in an air bath; the error of next importance is that in the transfer by means of the thermoelement.

The expansion coefficient of the bulb material was determined from 300° to 1400°. Between these limits the expansion is expressed by the formula $10^6\beta = 8.79 + 0.00161\ t$.

The temperatures, on the nitrogen scale, of the melting points of eight metals and two silicates between 400° and 1550° were determined with the ten per cent. Pt-Rh thermoelement as intermediary between the nitrogen thermometer and the fixed points. The metals were all analyzed by Dr. E. T. Allen. Two initial pressures were used, about 220 and 350 mm.; no systematic difference could be observed between the values of t derived from these two pressures. The final results are as follows:

Zinc	in air	in graphite	418.2 ± 0.3
Antimony	in CO	in graphite	629.2 ± 0.5
Silver	in CO	in graphite	960.0 ± 0.7
Gold	in CO	in graphite	1062.4 ± 0.8
Copper	in CO	in graphite	1082.6 ± 0.8
Diopside	in air	in platinum	1391.2 ± 1.5
Nickel	in N	in magnesia	1452.3 ± 2.0
Cobalt	in H	in magnesia	1489.8 ± 2.0
Palladium	in air	in magnesia	1549.2 ± 2.0
Anorthite	in air	in platinum	1549.5 ± 2.0

In addition, the melting temperatures of cadmium (320°) and of aluminum (658°) were obtained, but these metals were not used as standard points.

By adding the optically determined difference of 206° to the palladium point obtained above, the melting point of platinum is found to be 1755°, which is not more than 5° in error.

The curve of the 80 Pt 10 Rh thermoelement was found to deviate considerably from the very generally used parabola passing through zinc, antimony, silver and copper, and extrapolated above the latter temperature. The low value of 1710° for the melting point of platinum obtained by this extrapolation is therefore explained.

There is a disagreement of from 1.0° to 1.3° between the present scale, at its lower end, and the scale hitherto in use for calibrating the platinum resistance thermometer. The cause of the difference is not known. Between 500° and 1100° the present scale is about 1.5° lower than the Reichsanstalt scale in general use. Above 1100°, the temperatures of palladium and platinum obtained by Holborn and Valentiner are shown to be too high, and the new values are about those expected from previous estimates.

R. L. FARIS,
Secretary

THE NEW YORK ACADEMY OF SCIENCES
SECTION OF BIOLOGY

A REGULAR meeting of this section was held at the American Museum of Natural History, December 13, 1909, Chairman Frank M. Chapman presiding. The following papers were read:

Notes of an Ornithologist in South America: Mr. C. WILLIAM BEEBE.

The speaker gave an account of three expeditions to the forest regions of British Guiana, South America, for the purpose of studying and collecting the rarer birds of that locality. Many admirable photographs were shown of rare birds, among them the first photographs ever taken of the hoctyui, the female being shown in her characteristic crouching attitude near the nest and a flock of eleven in one tree. Incidentally some remarkable photographs of mammals were obtained, among them, one showing six capybaras and several young on a river bank taken by Dr. Hiram Bingham, and one of a manatee swimming with mouth and nostrils just above the water.

The Influence of the Nervous System in Regeneration: Mr. A. J. GOLDFARB.

The speaker briefly reviewed the suggestions that had heretofore been made to account for the fact that some animals were able to replace a missing organ, while others were unable to do so. A concise summary was then given of the experimental data that supported the conclusion that regeneration was dependent upon a stimulus exerted by or through the central nervous system.

The speaker then described the experiments that he had made during the last several years, upon

five widely different kinds of animals. In each animal the most painstaking care was taken to make certain that *all* motor or sensory or both of these cells, innervating a given organ had been completely destroyed. In spite of the total removal of the nerve stimuli the missing organ was regenerated in every case. Thus the frog tadpole regenerated its tail, the adult newt *D. viridescens* regenerated its tail and leg, the earthworm its head, the starfish its arm, and the planarian *D. lacteum* the anterior third of its body. It was pointed out that the agreement among these very different organisms probably signified that animals as a whole, whether during their larval or during their adult stage of development, regenerate their missing organs independently of a central nerve stimulus.

At the annual dinner and business meeting of the New York Academy of Sciences, held at the Hotel Endicott, New York City, December 20, 1909, the following officers were elected for the Section of Biology for 1910:

Chairman—Professor Charles B. Davenport.

Secretary—Dr. L. Hussakof.

A regular meeting of this section was held at the American Museum of Natural History, January 10, 1910. In the absence of Chairman Chas. B. Davenport, Mr. Roy W. Miner presided. The following papers were read:

Some Remarks on Myriapods: Mr. Roy W. Miner.

The speaker gave an illustrated talk on the myriapods, dwelling on their classification, evolution and morphology. Handlirsch's theory of the derivation of the Crustacea, Myriapoda and Hexapoda from pro-annelidan stock through trilobite forms was discussed in some detail, special attention being given to the evolution of the ancestral insects (Paleodictyoptera) from the trilobites, and their relation to the primitive myriapod stock. All the more typical myriapods were illustrated and their striking anatomical features commented on.

The Ultra-microscope and its Application to the Study of Microscopically Invisible Particles: Dr. Max Morse.

The ultra-microscope was devised by Zsigmondy and Siedentopf on the principle determined by Tyndall, that if a solution is examined under the microscope by means of horizontal illumination and not by light transmitted through it by the substage mirror, the particles within the solution polarize the light and thereby render them visible as scintillations against a dark background. By means of this instrument, solutions which appear perfectly homogeneous by means of the ordinary microscope are shown to be composed of particles in suspension. Bodies approaching the dimensions of molecules can be made visible.

Colloidal solutions have been analyzed by means of the ultra-microscope and shown to be suspensions of particles in a homogeneous medium. Thus, colloidal gold and platinum are resolved into such *pseudo*-solutions. Albumens fall under this heading and studies of their nature have shown that they are not homogeneous in solution, but are rather fine suspensions.

The ultra-microscope as first devised has been modified so as to be adapted to the study of living bacteria. The substage condenser of a microscope is replaced by one where the lens, in place of being biconvex, is parabolic and a stop is placed in the center of the disc so that no *direct* rays pass to the eye, but only those that have been polarized by the bacteria which receive the rays that are sent through them horizontally. The bacteria flora of teeth was shown. Spirochætes and rod forms are seen and their locomotor organs are made visible.

Notes on the Restorations of the Cretaceous Birds Hesperornis and Baptornis: Mr. Barnum Brown.

A few brief notes from a forthcoming paper were presented. The anatomy of *Hesperornis* as known from described material was discussed and compared with a skeleton recently mounted in the American Museum. In this specimen for the first time a complete tail is known. The swimming pose here chosen is accepted as the one that best represents the aquatic habits of the bird and more nearly conforms to the structure of the limbs. The peculiar arrangements of the palate bones in *Hesperornis* and the contemporary *Baptornis* were shown to constitute characters that distinguish them from all known birds.

Two new specimens have made possible a paper restoration of *Baptornis* which in some characters is more primitive than *Hesperornis*. The striking features are a complete fibula, heretofore known only in *Archæopteryx* and a very long tail of which fourteen vertebræ are preserved. There were at least sixteen. The palate bones are like those of *Hesperornis*.

L. Hussakof,
Secretary

American Museum of
Natural History